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The Storage Battery Decision. THE decision of Judge Coxe last week declaring void the Faure storage battery patent on the use of active material in the form of paint, paste or cement may have an important influence on the storage battery industry in the United States. While the company which, it seems, is the sole beneficiary of the decision does not state that it will make use of the process in question, yet it is probable that it will accept the general verdict that a pasted plate is the most efficient, and thus introduce what many will contend is a notable improvement in the manufacture of lead storage batteries. Aside from this, the fact that the long line of litigation which has almost paralyzed the storage battery industry in the United States for several years has presumably approached an end, gives, in itself, a bright outlook for the future, particularly if the former liberal policy is continued by the Consolidated Electric Storage Company toward manufacturers of other forms of lead batteries. On another page will be found the main points of Judge Coxe's decision, the claims of the victorious company and a history of storage battery litigation from their standpoint. We regret that the other side does not see fit to favor the electrical public with their view of the situation.

A Useful Laboratory. THE last issue of the *Bulletin de la Société Internationale des Electriciens* contains an account of the final inauguration of the Laboratoire Central d'Electricité at Paris. The laboratory, which has been in existence for some time, was organized by the society above named, which corresponds to our Institute of Electrical Engineers. As the French government donated the considerable sum left over from the electrical exhibition of 1881, and the city of Paris donated the ground upon which its present quarters are built (for which the money was largely presented by members of the society) the society has now to divide its management with those two powers, the director being a government telegraph engineer, but the scientific direction still remains largely with it. The equipment of the laboratory consists largely of gifts, of which several important ones were received from American electrical manufacturers. In an interesting address by M. E. Mascart when the laboratory was inaugurated in the presence of the Minister of Commerce, Industries and Colonies and other notables, its history was reviewed and its objects stated. At present the main work of the laboratory is making tests of electrical materials for manufacturers, calibrating and verifying measuring instruments, and testing and making reports on electric machines, apparatus and new inventions. Besides this industrial character, it is intended that it shall give instruction in practical electricity for students from professional schools and others, as well as furnish a means through which original investigations may be carried on. The charges for testing and other work have been placed at a low figure, but the income derived from this source in its temporary quarters was considerable. It will be seen that the laboratory promises to be an exceedingly useful institution, and is another example of the admirable method by which France maintains her technical standing in face of the fierce competition existing in Europe. The scheme is similar to that proposed for the national laboratory at Washington, which, unfortunately, is yet far from being realized. Should the various technical professional societies in New York together erect a common building, the main features of the laboratory described could be incorporated in the general engineering laboratory that has been mentioned in this connection; but this, too, has little prospect of accomplishment in the near future. Fortunately the laboratories connected with college and other engineering courses supply, to a certain extent, our lack of the French public laboratories, although, it may be remarked, but little of the benefit that could be derived from them is taken advantage of.

Judge Seaman and the Evidence. WHILE Judge Seaman's statement of the law in the opinion he handed down in the Oconto lamp case appears to be fair, clear and manly, his statement of the facts as developed in the case is open to criticism. While we do not believe that a proper understanding of the facts, where he was in error, would have made any change in his decision, yet it is clear that in the time at his disposal he was unable to grasp the meaning of some of the testimony. Judge Seaman says: "The fundamental thread-like carbon burner of Edison only became necessary as a means to subdivision of electric light, which was not contemplated by Goebel. The latter operated with a primary battery, for which the *larger pencil form of carbon or other material would answer as well*, would be more stable." Electricians will be at a loss to know why a larger pencil form of carbon would answer as well for the primary battery current. The contrary is the fact. The trouble Goebel had with his batteries was that they polarized so rapidly. If he could reduce this polarization he could run his batteries longer, and the best means in the world to accomplish this was by reducing the amount of current that was drawn from his battery, and this could only be accomplished by making his carbons of high resistance. Not only would a high resistance carbon prevent in a measure the polarization of his battery, but it would give it a longer life. The "larger pencil" would have been as fatal to Goebel as to Edison, though the objections to it that appealed to the two inventors were probably different. With Goebel the chief consideration was the cost of his current and the length of time upon which he could depend upon it. The less current consumed by each lamp the longer would his battery stand up, and the more lamps could be supplied from the same number of cells (for it appears from Wm. A. Goebel's testimony that Henry Goebel connected his lamps in multiple arc). The high resistance carbon, which alone would meet this requirement, also involved the use of currents at high potential. With Edison the cost of conductors was the main consideration. With the dynamo he had no polarization to contend with, and the cost of ampères was a consideration of but secondary importance. But as the heating effect of the current is proportional to the square of the current, or, in other words, as in order to obtain the same economy in distribution with two lamps or more as with one he was obliged to square the weight of copper as the ampères increased, he too was interested in reducing the current strength required for each lamp, and also adopted the most obvious method, viz., introduced a high resistance filament which also involved a high electromotive force. Judge Seaman's opinion that a "larger pencil" carbon was better adapted to primary battery illumination is a fallacy. In speaking of lamp No. 4 Judge Seaman says: "Goebel swears that it was operated, but experts who have examined the defect swear that it has existed from its manufacture and it could not have operated." This idea must have been obtained from the affidavits of Pope and Vandegrift, who testified that they believed that the break did not exist in the carbon, but probably existed between the copper and platinum wires, and from the testimony of Boehm and Jaeger, that, assuming that the break occurred at the point supposed, it must always have been there since the lamp was made, because those joints are buried within the glass bridge and are further protected by the inclosing chamber of the lamp, and must now be in the same condition as when the lamp was made, and hence that the lamp never has been operative. (Brief for complainants, Oconto case, p. 127; also Boehm's Beacon affidavit, p. 141; Jaeger aff., p. 157-8; Pope and Vandegrift, Beacon aff., p. 176-187). This lamp was tested, however, at the Physical Laboratory of Columbia College by Upton and Hammer and the break found not to be at the point supposed by Pope, Vandegrift, Boehm and Jaeger, but between the shank of the filament and one of the clamps, where it is likely to break through handling or use. The deductions based on the belief that it occurred within the glass bridge fall, therefore, but Judge Seaman seems to have overlooked this fact.

A Word to the General Electric. LIKE the man who remarked, cheerfully: "My wife is the most even-tempered woman in the world—she's always mad!" the General Electric Company can truthfully say that whether the lawsuits in which it is engaged are decided for it or against it the result is the same—the market price of its stock goes down with the same uniformity and persistency with which "the cat came back." When Judge Hallett refused to grant an injunction against the Columbia company, the price of General Electric stock showed its active sympathy by dropping several points. Now, when Judge Seaman decides to grant an injunction General Electric stock, instead of increasing in price, on the very day that Judge Seaman's decision is announced breaks so seriously as to affect a large number of other industrial securities. The decision was rendered in Milwaukee on Thursday, and, of course, was immediately telegraphed all over the country. The regular dividend of two per cent. was also declared, and the announcement officially promulgated that money for its payment was in bank. Notwithstanding all this, General Electric that week suffered the greatest loss of any stock listed or unlisted on the New York Stock Exchange. It fell 14 points, though it subsequently rallied over three per cent. from its lowest figure. At the present price of the stock investors would secure over 16 per cent. interest, providing that the present rate of dividends shall be maintained, and there seems to be no good reason to doubt that they will be. The bears in Wall street, and the unfavorable, though evidently on their face absurd, stories told of General Electric, are doubtless responsible in great degree for the present low price of the stock. For a month and a half this great property has been buffeted about in Wall street, apparently at the mercy of every bear clique which chose to use it to further its speculative ends. The management has seemed helpless in the present condition of affairs. The general situation so far as General Electric is concerned can to some extent be accounted for by the demoralized condition of the financial market and the advantage taken of it by bear speculators, coupled with the general distrust with which industrial stocks are viewed. The great need of money at present forces liquidation among the class who are generally believed to be large holders of General Electric, and they are naturally inclined to select that stock on account of its erratic behavior, entirely independent of other considerations. Neither is there any mystery why smaller investors should take advantage of the lower quotations; in these scary times they either lock up their money or invest it for the time being in old-fashioned securities, low prices having no temptation for them if offered in connection with securities in a class so discredited as that of industrials. Even should the great army of investors be inclined to take advantage of lower prices they have a large assortment of depressed securities to select from with which they are much better acquainted than the new one in question. We find no reason from recent events to lead us to change our opinion that the integrity of this company is well founded in a vast and enormously profitable business that is monthly growing in extent with the great expansion of the electrical field, and in which it has but one considerable rival. It behooves the General Electric, however, to promptly adopt some radical measure that will regain for it the confidence of the investing public, which, it appears, at least in a great measure, to have lost, and at the same time gain the good will and cordial commercial friendship of those engaged in electrical pursuits, who feel that they have not been considerately or even fairly treated by the General Electric, especially in the matter of the incandescent lamp. What in our opinion would do more than any other one thing to accomplish these two most desirable results would be for the company to rest on its present laurels so far as lamp litigation is concerned, sink no more money in profitless lawsuits, but license outside lamp manufacturers, using the money it receives as royalty to pay dividends. Investors prefer to have their savings in a property that is not involved in litigation, and surely the good will of other electrical companies is preferable to their active hostility.

Judge Seaman's Opinion.

On another page of this issue we give what was needed to complete the story of the incandescent lamp litigation up to date, viz, Judge Seaman's opinion in the Oconto case, heard at Milwaukee during the week beginning July 3 and reported exclusively in the issues of THE ELECTRICAL WORLD for July 15 and 22. We also give the views of one of the counsel of the General Electric Company, and an analysis of Judge Seaman's opinion from the standpoint of the defense by Mr. A. P. Smith, who took an active part in the litigation as one of the counsel of the Oconto company. As indicated in our editorial remarks on the subject last week, the whole matter hinged upon a question of law as to the measure of proof required to defeat an application for injunction on preliminary hearing in a patent case. In ordinary legal practice the burden of proof is very properly put upon the complainant. For instance, if A brings suit against B under an alleged agreement by which he claims that B and C and D were each to pay him $1,000 for certain services, which he duly rendered, the fact that he may obtain judgment against B does not of itself entitle him to judgment against C or against D on the same transaction, unless they were made parties to the suit and had full opportunity to defend it. In other words, the burden of proof is still upon A to show that C and afterward that D owes him the money, irrespective of the judgment obtained against B. In patent cases, however, the practice is quite the reverse of this. When a patent, after a *bona fide* contest, and especially after a long and expensive litigation, is finally sustained by the United States Supreme Court, circuit judges are inclined to consider the questions involved as to the scope of the patent finally adjudicated, even as against those who were not parties to the suit. This makes a very serious difference to the manufacturer against whom proceedings may be begun for alleged infringement of the patent, as the so-called outside lamp manufacturers have found to their dismay. As in such cases the United States judge will grant on an *ex parte* application a restraining order prohibiting the further manufacture or sale of the articles during the pendency of the suit. the manufacturer receives no notice until after the injunction has been granted. In the case of some of the lamp manufacturers, the first intimation they had that their factories would have to be closed up instantly, and for an indefinite period, was when they read in their morning paper at breakfast the fact that a restraining order had been granted. Of course an application can be made to have the preliminary injunction removed; but here again the defendant in a patent case seems to be placed at a disadvantage that is not experienced, so far as we know, in any other class of lawsuit. When what has since become known as the Goebel defense was first introduced in the Beacon case at Boston, Judge Colt held that the burden of proof being on the defendants to show "beyond a reasonable doubt" Goebel's priority of invention. He said in his opinion that the quality and quantity of the defendants' evidence were not sufficiently clear and convincing as to be beyond a reasonable doubt, and according to his interpretation of the law complainants were therefore entitled to an injunction. Judge Hallett, in the Columbia case at St. Louis, also passed upon the Goebel defense, but while agreeing with Judge Colt as to the character of the evidence presented, interpreted the law differently and decided that on the showing made the complainants were not entitled to an injunction. Judge Seaman follows Judge Colt in his decision, and says that "it is clear that the presumption must be in favor of the patent, and that it cannot be overthrown by a mere doubt," and adds that new evidence in such a case "must be sufficient to raise a presumption that it would have defeated the patent had it been produced at the trial. This would demand, at least, the full measure required to overcome the presumptive force of the patent, and that every reasonable doubt be resolved against the defense." Then, while admitting that the Goebel story "is interesting, circumstantial and in many respects plausible," he goes on to show wherein doubts exist, and decides that the complainant is entitled to an injunction. The decision is, of course, a victory for the General Electric Company. At the same time the fact that Judge Seaman gives the Oconto company the right to apply for a bond from the General Electric Company to indemnify it for damages resulting from the closing of its factory in case at final hearing decision should be rendered against the General Electric Company, goes to show that the judge thought there was something in the Goebel defense. Looking at the matter dispassionately, it is very evident that the General Electric Company is by no means in as strong a position to-day as it was at the close of the Beacon case. At that time it had an opportunity of fostering the lamp industry in such a manner that it could have made a large amount of money out of its patent. Probably not one lamp manufacturer in the country would have objected to paying a royalty, and a very large royalty, to the General Electric Company in preference to tedious litigation and the uncertainty of the situation. Instead of pursuing a liberal policy, however, the company managed to antagonize those who would have preferred to be on friendly terms with it, and it is a question whether the General Electric will again have the opportunity that it then had of reaping, everything considered, any material advantage from its incandescent lamp patent. Prevented from manufacturing Edison lamps on a royalty, several of the lamp manufacturers have brought out lamps that, it is believed, do not infringe the Edison patent, and thus feel themselves independent. The cost of the litigation to the General Electric Company must already have been large, and if the market price of the stock of the company can be looked upon as any criterion, the result of the litigation thus far has not been profitable to the company. On the other hand, the Goebel defense has made material progress since the time of the Beacon case. No better measure of this can be given than the following extracts from the opinion regarding it held by Judge Colt at that time and by Judge Seaman now:

OPINION OF JUDGE COLT.

"It is simply impossible under the circumstances to believe that a lamp so constructed could have been made by Goebel before 1872. Nothing in the evidence warrants such a supposition, and other things show it to be untrue. . . . A court of equity should not look with favor on such a defense."

OPINION OF JUDGE SEAMAN.

"Against all of the improbabilities of this claim, the story as related by Goebel, in his several affidavits, with detail confirmations by many witnesses, is interesting, circumstantial and in many respects plausible."

Patent Office Delays.

To the Editor of The Electrical World:

I think it might be of interest to you to know the condition of affairs in the Patent Office so that you could say something about it in your journal, whose readers have been deprived of your regular illustrated record of electrical patents. I inquired at the Patent Office when the "Gazette" would issue and was given the same answer we received three weeks ago: 'That it would be out in a few days.' Three issues of the "Gazette" are now wanting, with no definite promise as to when it will appear. The patents were not delivered to the attorneys until Monday, and of course the photo-lithographic copies of the patents were not distributed among the portfolios of the various examiners of the Patent Office until about one week after the issuance of the patents. The result of this is that the entire work of the United States Patent Office has been blockaded by giving the photo-lithographic work of the Patent Office to an inexperienced firm. As a consequence, the quality of the work performed is much poorer than that done by the former company, and yet the saving to the government is only a small percentage of the cost of doing the work. Petitions have been pouring in to the Commissioner of Patents and the Secretary of the Interior urging that some step be taken to place the work in more competent hands. But thus far no attention has been paid to these appeals. In the mean time confusion is becoming accumulative in the Patent Office, and many months will be required to restore the work to its former order.

A PATENT ATTORNEY.

Laboratory Notes.

BY LIEUT. F. JARVIS PATTEN.

The following experiment recently performed at my laboratory I have not seen before described, though it may be known to experimenters that a biphase motor,

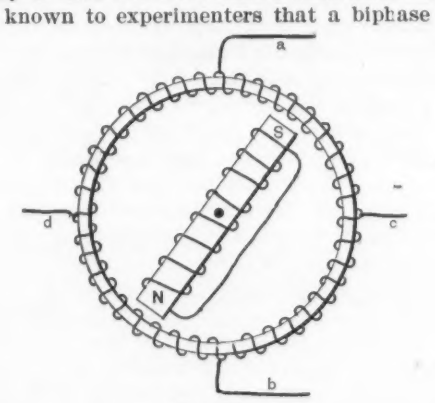

FIG. 1.

with closed induced circuit, will, after being brought to synchronism, continue running as before if one of the circuits is opened and one of the biphase currents is discarded from the system.

The simplest form of biphase (Tesla) motor, Fig. 1, was started in the ordinary way by introducing two currents in quadrature through the leads a b and c d. The revolving pole N S was provided with a closed induced circuit winding. After synchronism was reached the circuit c d was repeatedly opened, always without stopping the motor. I was, however, quite surprised to find that the motor not only did not stop, but that it would follow the generator in perfect synchronism through wide ranges of speed up and down from 200 to 1,300 revolutions per minute, which were the extreme limits at which I could vary the generator speed.

Evidently the machine was then running as a single phase motor, having what would appear to be a closed field (induced) circuit. If this were so, why, then, should not some form of single phase alternator behave in the same manner if brought to synchronism?

I then made an arrangement like that shown in Fig. 2, using a single phase alternating current only. In a ring winding G, G, the current was introduced at the diametrically opposite points a, b, and sufficient current to excite the field N S was rectified by the commutator c c, and this motor was brought to synchronism, when, of course, it continued revolving as an ordinary synchronous motor with a rectified (direct current) field. This being done the switch W was closed and the brushes thrown off, when the motor continued to mote as before, and like the other machine would follow the generator under the same changes of speed. By a variation of this, which I will explain at a later day, I managed to get a motor running when supplied by a single

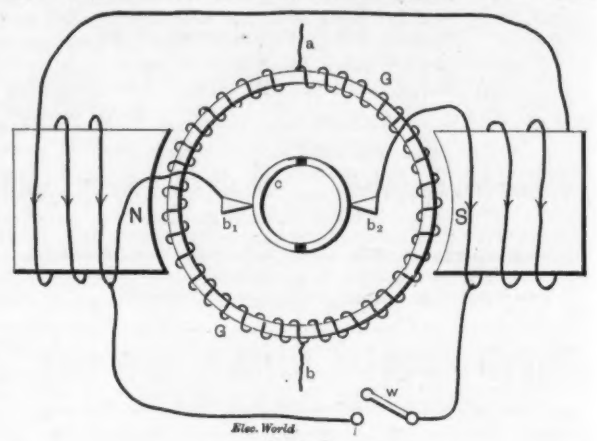

FIG. 2.

phase alternating current, without the use (after being brought to synchronism) of commutators, rings or brushes of any kind and without resort to the embedded armature winding and with a comparatively poor magnetic circuit. Of course, not all forms of machines can be made to do this; in fact, I apprehend there are but few types.

From the experiment first described, however, the following method of operating alternating current motors by means of a single phase alternating current is obvious. A biphase motor is used as such for starting only. The main current of supply, which it is intended shall eventually drive the motor, will be introduced through the leads a, b, while a second current, derived from this and in quadrature with it, is taken to the leads c, d, Fig. 1. When the machine has reached the synchronous speed, which requires but a few seconds, the latter current may be switched off, when the machine will continue running as a single-phased.

There is a cheap and simple way of deriving the second or starting current in quadrature with the first.

The Hutin and Leblanc Motor.

BY JOHN F. KELLY.

The electro-financial organ published by the distinguished Dr. Cornelius Herz, which for some time back has been so anxious to decry the originality of American engineers, contains, in its issue of June 10,* an article descriptive of a new alternating current motor due to the gentlemen, whose merits, for reasons not unconnected with the stock market, it is now trumpeting. Of course I read the article with great interest, being anxious to discover the nature of real originality. This entirely original motor appears to be Elihu Thomson's motor of 1887, with some modifications, none of which is due to MM. Hutin and Leblanc. The armature is double wound and has two distinct but interleaving commutators. This method of construction is due to Edward Weston and was patented by him over ten years ago. A great number of machines built by the United States Electric Lighting Company, according to my plans, have armatures so constructed. It was applied by Mr. Stanley and myself to alternating current motors a couple of years ago, and its use for the same purpose has been repeatedly urged by Mr. Swinburne. The magnetic shunts connecting the poles of the machine were introduced by one of the engineers of Siemens & Halske. They were also used by Mr. Stanley and myself in connection with our commutating motors, but for alternating current work we found them to have serious drawbacks. The commutator brushes, with resistances interposed between the sections, are due to Dr. Hopkinson and have been widely tried. Indeed, the use of carbon and other high resistance brushes is but another application of the same idea. It appears, therefore, that this so novel motor contains not a single new element, and to me, at least, not a single new combination. Nevertheless, although MM. Hutin and Leblanc cannot claim to be inventors of any element in the motor, they deserve well of the world, if they have succeeded in so designing it as to make it practical for existing circuits. For low frequencies the matter is comparatively simple.

Visible Representation of Lines of Electric Force.

The Lond. "Electrician" describes the following experiment of Mr. Kolbe: Purified anhydrous oil of turpentine is poured to a depth of two centimetres into a flat cylindrical vessel, and some sulphate of quinine is added; two wire prings are attached to the rim of this vessel, so that the two metallic balls at their ends dip into the turpentine; the whole is placed on a black background and the quinine is well distributed over the surface; when the two wires are attached to an influence machine turned very slowly the white crystals arrange themselves so as to form beautiful curves representing lines of electric force and resembling the brush discharge.

*See THE ELECTRICAL WORLD, July 15, p. 43.

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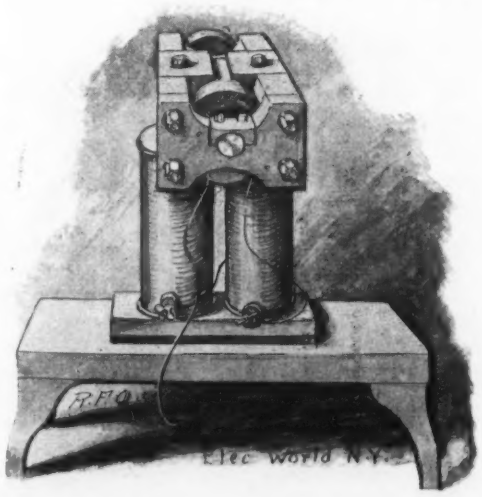
KEENLY appreciated by most of the people of the Occident are things bearing the imprint of the Orient. Whether it is that they always carry with them some of the odor and substance of dreamland, with which for some reason the Far East is associated in our minds, or that they attract us by their wide departure from those things with which we are more familiar matters not—the charm is there. The architecture of the Moors is one of the pleasantest of these, and this has been chosen by the Ansonia Electric Company for the beautiful pavilion they have erected at the north end of the gallery floor of the Electricity Building. At this point, occupying the whole north gallery, commanding the finest possible view of the great nave, stands the pretty Moorish structure in which they display their varied wares.

A more desirable location nor a more desirable tenant could scarcely be chosen, and those who find themselves too tired to mount the gallery stairways will miss much that they should have seen, not only in this extensive exhibit but in the numberless other ones on the same floor. Nor will fatigue be a sufficient excuse for missing this part of the building, for the Ansonia company have provided against this by exhibiting as part of their display a small passenger elevator upon which all are invited to ride free of charge.

There is still another strong inducement held out to the sightseer, whether he be tired or fresh, and that is the restaurants which lie both to the right and to the left, where creature comforts are dispensed at so much per portion, whether it be doled out by the cup, the plate or the glass.

These restaurants are not a part of the display under discussion, however, but the Ansonia company have installed a display of their own of no mean proportions which partakes of this character, and this will be found at the east end of their exhibit. It consists of an electric kitchen where things are cooked without fire, and the mysteries of electric heating are practically demonstrated and explained. A little further to the west the good housewife and the architect will alike be attracted by the electrical devices for embellishing the home and adding to its comfort. Here closets and doors are arranged so



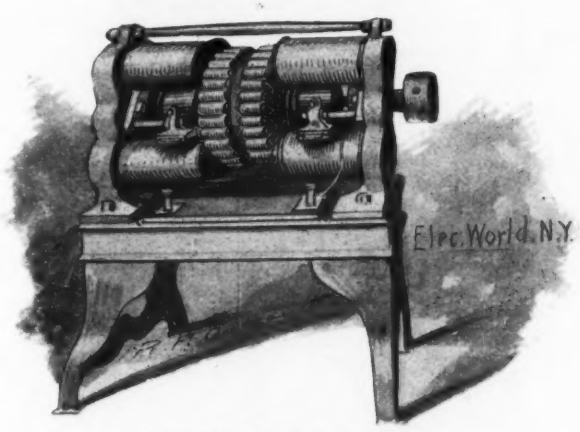
THE FIRST PRACTICAL DYNAMO IN THE UNITED STATES.

that by their opening or unlocking they are illuminated from within, only to be darkened again by the reverse operation.

Adjoining this, to the right, as one faces the south, is a handsome monogram of the letters A. E. Co. in colored acorn-shaped lamps which, by a hidden commutator arrangement, are successively flashed and extinguished, only to repeat themselves again when the cycle is complete; and near by is a handsome glass showcase, in which samples of the same lamps as those in the sign are displayed in a profusion of bright colors. These lamps are of interest especially for this—aside from their intrinsic merit—in that the New Sunbeam (for by this name are they known) was the direct outgrowth of the lamp litigation which created so much disturbance in electrical circles in times of quite recent date. They were one of the first, if not the first, of the non-infringing lamps, to which the demands of the times gave birth. Non-infringing, we say, for they contain neither an all glass receiver, a vacuum or platinum leading-in wires sealed into the glass—the three features, it was claimed, all the others infringed. How these three elements were avoided in a practical lamp will be shown later on.

Then as one continues to the west other electrical appliances for a great variety of purposes are attractively displayed, and the battery and the conductor and the insulating material are shown in appropriate ways.

The building or temple is triune in character, there being three distinct pagodas thrown into one. The columns which support the light canopy and arches are covered with Prussian blue plush, in bright contrast with the sombre neutral tints of the structure itself. Within and without the flags of all nations are plentifully hung, gaving a gala appearance to the tasteful designs.

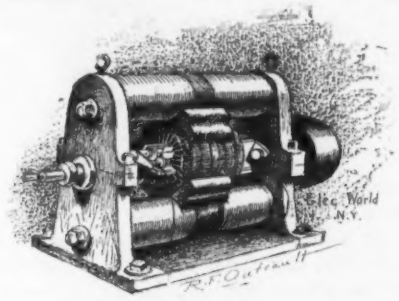


THE CENTENNIAL DYNAMO.

In the detailed examination which we are about to undertake the three pavilions or pagodas will be separately considered. As an explanation in preface, it may be well to remark that the displays here described are from a number of factories. The Ansonia Electric Company, as all electricians know, while a large manufacturer itself of electrical supplies, is also the agent for a number of others. The plan has, therefore, been adopted of making separate displays of all these agencies—separate in a sense, but combined as a whole. That no mistake may be made and each receive its due credit, the name of each company represented is attractively displayed on transparent glass signs with white letters on blue backgrounds. These are suspended around the eaves of the building, and form in themselves an attractive display. The signs thus shown are those of the American Electric Heating Corporation, of 274 Purchase street, Boston, which displays the electric heating and cooking apparatus; the Star Electric Lamp (New Sunbeam) Company of Chicago; Wm. Burnley, of North East, Pa., Burnley primary batteries; the Electric Manufacturing Company, of Dayton, O., showing Fletcher's electric specialties; the India Rubber and Gutta Percha Insulating Company, of New York, showing Habirshaw cables and wire; Otto Randa, whose display is not yet in place; Edwards & Co., 144th street and Fourth avenue, N. Y., bells, annunciators, watchmen's clocks, etc.; The National Electric Manufacturing Company, Milford, Conn., fire alarm goods; the Helios Electric Company, Philadelphia, Helios arc lamps; J. Lang & Co., Chicago, switches; The Stanley Electric Manufacturing Company, Pittsfield, Mass., transformers; The Electric Thermostat Company, of Minneapolis, automatic temperature regulators; Richard Pfund, 153 Broadway, Brooklyn, N. Y., plunge batteries; The Cutter Electrical and Manufacturing Company, 27 South Eleventh street, Philadelphia, flat, push and key switches and flexible brackets, and last, but not least, the Frisbie Elevator and Manufacturing Company, New Haven, New York and Chicago, electric elevators.

THE WEST PAVILION.

Taking up the detailed examination of the exhibits in the reverse order in which we have briefly reviewed them, we enter the western pavilion from the west. This is octagonal in ground plan. In its centre is erected

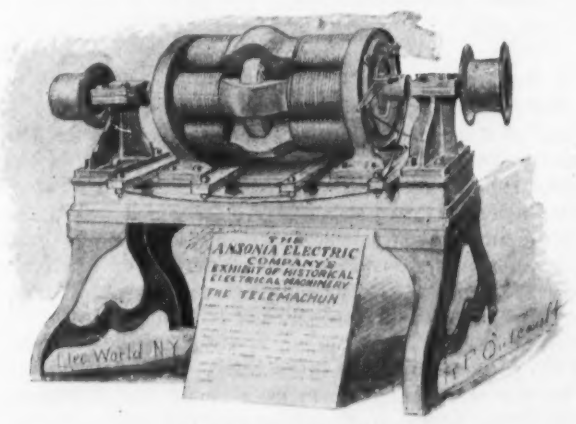


OLD CORNELL DYNAMO.

the Edwards sample board, a large oaken affair well covered with electric bells, annunciators, watchmen's clocks, push buttons, door openers, gongs, burglar alarms and other house fixtures of an electrical nature, so necessary in these times to a well-equipped house. One of these instruments attracts especial attention, viz., a large clock annunciator, which, in a case of oak to match the sample board upon which it rests, is a handsome clock combined with a system of annunciator drops which may be connected with the various parts of the house. These annunciator clocks are becoming exceedingly popular for private residences of pretension, and now frequently form part of the architect's plans. They are sometimes designed to be built into a convenient nook or alcove, but more often become fixtures only after they are connected up. Directly over the centre of the sample board is a handsome oxidized silver electrolier of seven lights. The shades are of elegant cut glass, of an exceedingly chaste pattern.

Looking north from the centre of the pavilion, the right and left hand sides of the octagon are occupied by tables upon which are displayed samples of Diamond Carbon and Edison-Lalande primary batteries and Stanley transformers and Crocker-Wheeler fans.

Both brands of batteries have been long known in the trade, and require scarcely any introduction at this time. The Diamond Carbon battery, as is well known, is a standard open-circuit cell, having numerous carbon pencils for the negative element, arranged around the positive zinc in a circle. The exciting fluid in this cell is the reliable sal-ammoniac solution, which is by far the most popular for open-circuit cells. The Edison-Lalande cell is another popular style, and is an improvement in detail



THE TELEMACHUN.

of the old Lalande cell of France. In this plates of cuprous oxide carry the positive binding post while the usual zinc carries the negative. The exciting fluid is an alkali—either caustic potash or soda, and a cover of mineral oil is usually floated on the solution to prevent access of air. While the electromotive force of this cell is considerably less than that of the Diamond Carbon, its internal resistance is considerably less, and the current it is capable of giving is considerably greater. It holds up

its electromotive force much better than the sal-ammoniac cells, and may be recharged as a storage battery when its elements have become exhausted. Thus used, its life is almost indefinite, as the chemical changes resulting from discharge are reversed on recharging.

The Stanley transformer, only recently perfected and placed on the market, already stands at the very head of its class. It has a solid, moisture-proof core and a

SOME OF FLETCHER'S SPECIALTIES.

weight efficiency the highest that has thus far been obtained. It is claimed, also, that it is absolutely proof against lightning, and so confident is the company of the truth of this claim that they warrant each instrument sold with a guarantee for five years against injury from this cause.

Just east of the Edwards exhibit, to the right of the entrance to the central pavilion, is a very neat exhibit of the Electric Thermostat Company, showing the practical operation of their system of automatic temperature regulation. On what appears in its upper part to be an ordinary oak mantle the thermostats are placed, and below is what is intended to represent the basement of a dwelling. In this are two dampers, one under the grate bars of a furnace and the other in the flue. As the temperature above exceeds or falls below the desired point the sensitive thermostat throws into operation a small motor, which either opens or closes these dampers. The system is adaptable to all methods of heating, and may be made to operate so as to maintain any predetermined temperature. The south and southwest sides of the octagon are respectively occupied by tables, upon which are shown more Stanley transformers and a handsome collection of Lang & Co.'s switches.

HISTORICAL EXHIBITS.

The names of Moses Gerrish Farmer and Wm. Wallace, of Ansonia, Conn., are those best known in connection with pioneer dynamo work in America, for the one or the other or both, in conjunction, made the most noteworthy early attempts in this line. Of Mr. Farmer's work we have already briefly spoken in a previous article. Of Wallace's it is appropriate to speak at this time. In the Ansonia exhibit are shown three of his earliest machines. In the north entrance to this pavilion is one labeled as follows:

THE FIRST DYNAMO.

This machine was built by Mr. Wm. Wallace, of Ansonia, Conn., in 1873, and used as a magneto. Early in 1871 it was connected up and used as a dynamo. It is the first dynamo constructed and operated practically in the United States.

The machine in question is about 2½ feet high, with poles of the rectangular horseshoe shape, with long, slender legs. The yoke is at the bottom, forming a part of the base of the machine, and the armature is at the top, the whole resembling very closely a reversed Edison dynamo in its earliest form. The armature is of the ring type and the commutator segments of 24 copper bars are insulated from each other by air insulation. The brushes, two in number, are of copper wire, differing but slightly in appearance from the wire brushes of the present day.

At the west entrance is another of very different type. This bears on a placard the following legend:

The Wm. Wallace dynamo-electric machine, constructed by him early in 1875. Was exhibited at the Centennial, and was in operation furnishing current for electric lights in Machinery Hall during the entire period of the Centennial.

It is of the four-pole type, with its longitudinal axis horizontal. The yokes of the field magnets, resting upon a cast iron base, contain the bearings of the armature shaft, and thus far the resemblance to the modern Brush machine is striking, but it continues no farther. The armature has no counterpart in recent construction. Midway on the shaft, between the two pairs of polepieces, is a cast iron disc, and upon each face of this are 25 small iron projections, upon each of which is wound a separate coil. Thus there are in a sense two distinct armatures of 25 coils each and these two sets of coils each have their own separate commutator. The commutators are placed on either side of the armature between the fields of the magnets, but the brushes, of which there are four, two to each commutator, are cross-connected to two binding posts and supply but a single circuit.

Crude as this machine appears in the light of our present knowledge, it was considered quite an achievement at the time, and the writer well remembers what an acquisition it was considered, when in 1876 or 1877 one was secured at the School of Mines to run a lecture lantern. It was placed in the basement and had an engine to itself, and when in operation on a single lamp shook the whole building perceptibly, and made so much noise that conversation in ordinary tones was almost inaudible in the lecture-room immediately above. But it gave a splendid light, and replaced for some time the large battery which had prevoiusly been used for a similar purpose.

In the southeast corner is another historical exhibit of another make. This bears the following inscription:

ANTHONY & GRAMME.

This dynamo was constructed by the Department of Physics of Cornell University, at Ithaca, N. Y., in the summer of 1874 or 1875, from designs made by and under the supervision of Prof Wm. A. Anthony. It was first employed in lecture experiments, taking the place of a large Grove battery. It was in operation at the Centennial Exposition in 1876, and was used for several years with the Wallace Plate Carbon lamps to light the university campus at Cornell. For some years it has been in regular service as a motor in the Cornell machine shops. Its capacity is 4.4 kw., or about 6 h. p.

This machine is about 2½ feet long and 2½ feet high, of the consequent pole type with ring armature. The coils on the latter, of which there are 92 in all, are alternately taken off on either side to commutator segments, each commutator consisting of 46 segments, upon which bear at the present time carbon brushes. With the exception of the double commutator arrangement this machine is not unlike, in general appearance, the Wood arc machine of the present day.

While on the subject of historical exhibits it may be well to mention here still another which is situated in the south entrance to the central pavilion. This bears the following inscription:

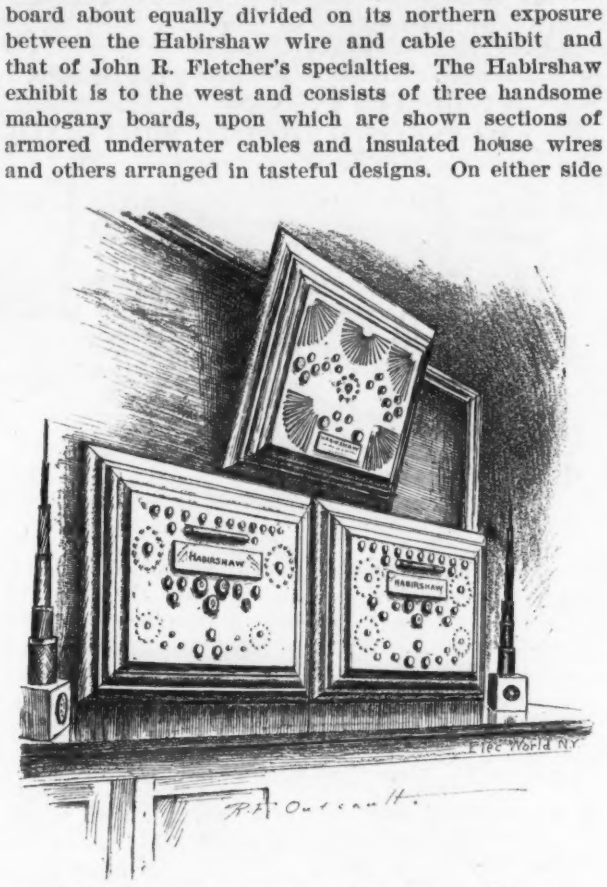
This dynamo-electric machine was operated in Machinery Hall at the Centennial Exposition, in Philadelphia, in 1876, to illustrate the transmission of power, and is the first dynamo in the United States constructed with an armature built up with laminated plates.

This machine has six double magnets of the consequent pole type and a disc armature. The coils on this, as in the last described Wallace machine, are also alternately taken out on either side to separate commutator blocks, of which there are 84 in each commutator. Air insulation is again employed between the segments, and the brushes, of which there are four, two to each commutator, are of copper wire. This machine is also the handiwork and design of Mr. Wallace. This collection of historical apparatus is one of extreme interest, but it is hard to realize the progress that has been made in so few years, and that an apparatus made so late as 1874, 1875 or 1876 can be truly called historical, and yet such is the fact. Still, while as compared with the modern machines these old ones lack much in efficiency and seem crude in design, one cannot but be struck with the similarity existing between these, among the first samples of the electro-dynamic machine, and some of the more popular commercial machines of to-day.

THE FRISBIE CONSTANT SPEED DIRECT ELECTRIC ELEVATOR

THE CENTRAL PAVILION.

Leaving now the western pavilion and entering the central one, our attention is at first attracted, as we view the exhibit from the north, to a large sample board about equally divided on its northern exposure between the Habirshaw wire and cable exhibit and that of John R. Fletcher's specialties. The Habirshaw exhibit is to the west and consists of three handsome mahogany boards, upon which are shown sections of armored underwater cables and insulated house wires and others arranged in tasteful designs. On either side



A DISPLAY OF HABIRSHAW WIRES AND CABLE.

of the mahogany sample boards is shown a sample about three feet long of the Habirshaw double armored underwater cable, cut away in pyramidal shape, exposing to view the construction of the various layers of which the completed cable is composed. The one on the left contains a stranded cable of 350,000 circular mils cross-section, together with six separate insulated small pressure wires. That on the right is of 1,000,000 circular mils cross-section without pressure wires. Both were made for the Edison Electric Illuminating Company of Boston, Mass. The cables and wires of the Habirshaw brand are made by the India Rubber and Gutta Percha Insulating Company, of New York, under the direction of Mr. Wm. Habirshaw himself, an expert practical chemist of over 20 years' experience in New York, who has given the subject of insulation scientific attention, the aim being to make each particular cable meet the special requirements for which it was intended. Pure Para rubber alone is relied upon for high insulating properties, and this, together with the other materials employed, has given this brand of cables such a high reputation that it has been adopted by the United States government as the standard for its marine work, and has been supplied to many of the government's cruisers.

In the display of Fletcher's specialties are found samples of safety windlasses, sleet-proof pulleys of the various patterns, both single and twin, as well as duplex, wire holders with porcelain and opalescent glass insulation for outside work, and wood insulation and corner cleats and moldings for inside work, insulating pins and brackets, the Dayton arc light cut-out and lamp hangers. Fletcher wiring pendants and Danels arc light supports complete this interesting exhibit.

On the south side of this board the Ansonia Electric Company shows a large line of annunciators, push buttons, bells, gongs and spark coils of its own make. Near by on another board are exhibited a collection of Wirt indicators for showing both current and voltage. Switches and fuse boxes are also displayed. Occupying the west half of the south front of the central pavilion are two handsome glass cases, in which are displayed

a series of simple plunge batteries of one, two, three and more cells, toy motors, miniature lamps, fire alarm boxes, messenger calls, double-pen register tickers, telegraph keys, sounders and relays, and at the end of one of these cases is a small oaken door equipped to illustrate the Wilkinson & Tinkham electric lock, latch and door opener. This is an arrangement especially adapted to apartment houses, by which a tenant in an upper flat, after having satisfied himself that his caller at the street door is a proper person to admit, may unlock that door from his own apartments without descending to the lower hall for the purpose.

The place of honor in the central pavilion, occupying its exact centre, is a handsome pyramid of wires of the Ansonia Electric Company's own manufacture. The bottom of this consists of five large reels of trolley wire, succeeded by five smaller reels of Shield Brand, moisture-proof line wire, and these again by the same number of still smaller reels of weather-proof wire. Above these come reels of cotton magnet wire, both round and flat, and the apex is completed with spools of smaller magnet, annunciator and office wires. The whole is surmounted by an oxidized silver electrolier with five lights inclosed in ground and cut-glass conical shades. This makes a very pretty centrepiece for the whole display, and shows to advantage this branch of the Ansonia company's manufactures.

Just north of this pyramid are two more glass cases. In the one to the west are shown induction coils, horseshoe permanent magnets, Ajax dry batteries, fuse boxes and cut-outs, rosettes, etc., and in the eastern case a collection of New Sunbeam lamps in ruby, ground glass,

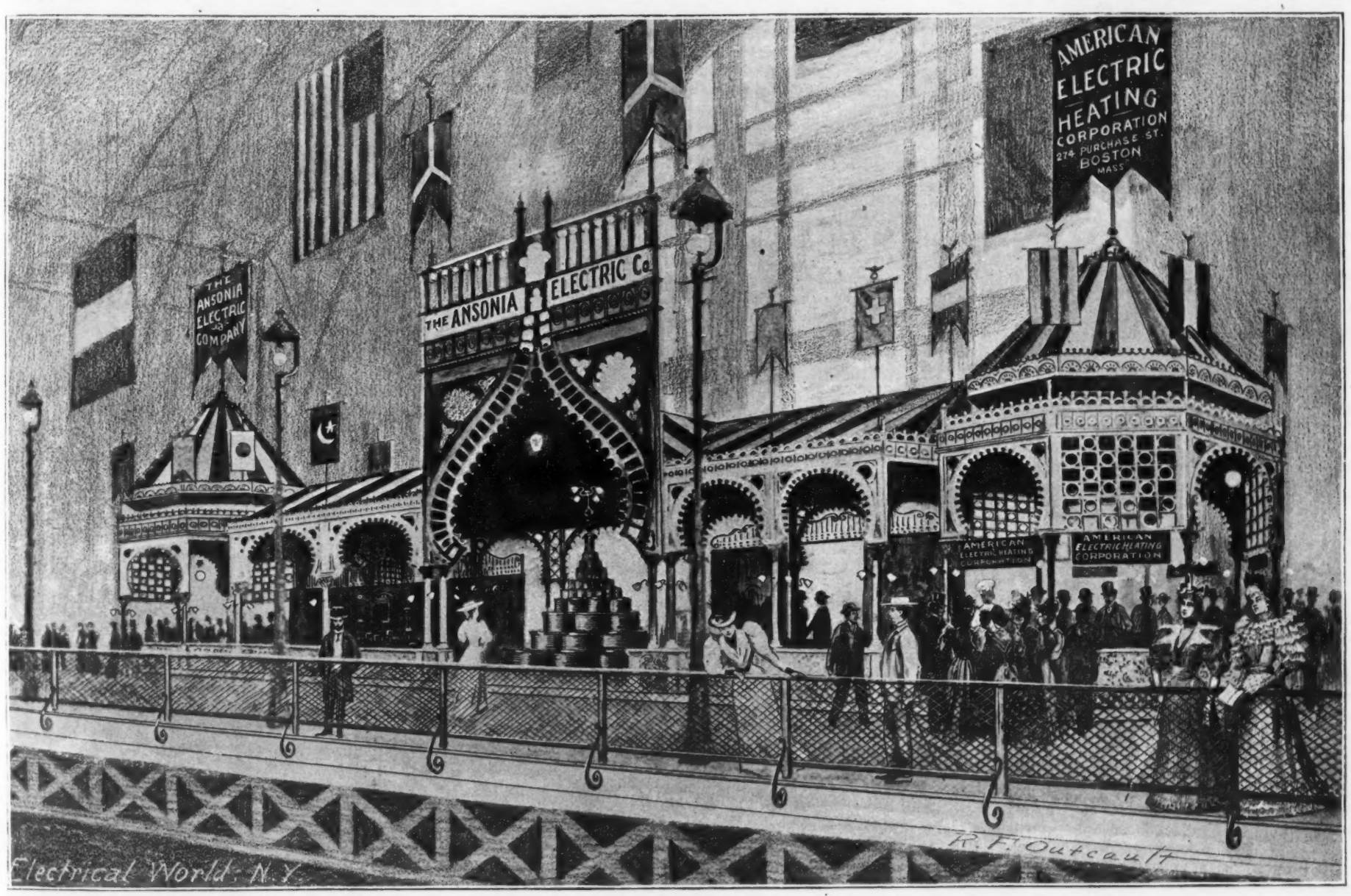
COOKING BY ELECTRICITY.

blue, green, and clear glass. These are all of the acorn shape, which has been adopted as part of the trademark. These lamps, while tastefully arranged, according to color, lie loose and are not in commission, but their brilliancy of color is well shown on a board near at hand, upon which has been outlined in the various colored lamps the letters, S. E. L. Co., meaning Star Electric Lamp Company. These letters are arranged in monogram, each in lamps of a different color, which by means of a commutator arrangement driven by a small electric motor are flashed in succession to full candle-power, producing a most brilliant and striking effect. It will be remembered that according to Judge Wallace's decision, and others which followed, all lamps consisting of an all-glass receiver containing a filamentary carbon surrounded by a vacuum and connected to circuit by means of platinum leading-in wires sealed into the glass, were held to be infringements of claim 2 of the original Edison patent. The New Sunbeam lamp was the result of an effort to make a commercial incandescent lamp which would not be held to be an infringement of this patent. In this lamp the receiver is not wholly of glass, but is partly of platinum, to one side of which the lamp terminals are soldered, and to the other the supporting wires for the filament. Instead of a vacuum the chamber is filled with some hydro-carbon gas, the exact nature of which is not made public, but it is claimed for this gas that it has the property of protecting the filament from disintegration, so that it maintains its original candle-power throughout the life of the lamp. So much pleased are the manufacturers with the success of their new lamp that they have publicly stated that they would not again make a vacuum lamp, even if such construction were free to the public. The New Sunbeam is made with bases to fit all sockets, and is now being largely supplied both to the trade and to private consumers.

While on the subject of lamps we may speak of the arc lamp, for which this company is the agent. This is the Helios lamp, well known abroad, but somewhat new to this country. It is manufactured for the American trade by the Helios Arc Lamp Company, of Philadelphia, and it is intended to be used on alternating incandescent circuits. It is much shorter in length than those lamps with which we are more familiar, and thus is well adapted for commercial use. The globe and general exterior design is artistic and tasteful, and the parts are so closely connected that it is said to be both water and bug proof. It feeds both from the positive and negative side, and in this sense is a focussing lamp. Its interior mechanism is not stamped, but is all cut work, and is exceedingly simple in construction. The lamps are wound for thirty volts, a special transformer, which was supplied by the Ansonia Electric Company, being used to transform the current from the 1,000-volt primary to the voltage required; thus a single lamp may be tapped into the primary circuit by means of this special transformer, or 3, 5 or 7 may be placed there in series according to the potential supplied. Of these lamps there are five in the Ansonia display, and some

AMERICAN ELECTRICAL HEATING COMPANY'S COOK.

1,500 in the Midway Plaisance, Transportation Building, and distributed throughout the grounds. The extreme


THE ANSONIA ELECTRIC COMPANY
THE ANSONIA ELECTRIC Co.
AMERICAN ELECTRIC HEATING CORPORATION 274 PURCHASE ST. BOSTON MASS
AMERICAN ELECTRIC HEATING CORPORATION
AMERICAN ELECTRIC HEATING CORPORATION
R. F. Outcault
Electrical World, N.Y.

A GENERAL VIEW OF THE ANSONIA ELECTRIC COMPANY'S PAVILIONS.

softness and steadiness of their light are remarked by everybody, and these features, together with their artistic appearance, are rapidly winning them favor among the public at large. On the reverse side of the lamp monogram board is the interesting display of the Cutter Electric Manufacturing Company, of Philadelphia. Here are shown a couple of doors, one of which, upon opening, turns on the current to an electric lamp and cuts it off again when closing. This is intended to represent an adaptation to closets, whereby the interior is illuminated the moment the door is opened, and the light turned out when it is no longer needed, by the closing of the closet door. The other one is intended to show adaptation to hotels, by which the guest when locking his door, either upon retiring, or upon leaving the room, by that action turns out his light, so that no current is wasted while he is absent or asleep. This switch is also adapted to other uses, as the turning on or off of clusters of lights in public buildings; as there is no access to the switch except through the keyhole, only those possessing keys can operate the switch. There are two keys, however, one for operating the switch, and another to remove the face-plate in order to give access to the switch in case repairs become necessary. In addition to the above a line of commutation flush switches are shown. These are intended to enable one to control lights at distant points in the house as well as near at hand, as is customary. They are made for two or more circuits, and are so connected

that each and every switch will operate any light or lights in the circuit wherever they may be placed These will be found a great convenience in so many ways that examples need scarcely be cited. On this same board are also shown samples of the C-S flexible brackets and reflector shades.

On the south side to the east of the entrance to the pavilion are two more large glass cases, in one of which are shown samples of the Simplex carbon battery, the Burney Cartridge battery and Gravity and Ajax cells. Additional samples of Cutter's goods are also shown here. In the other case are shown Grenet, Sampson and other batteries handled by the Ansonia Electric Company.

At the eastern end of the main pavilion is another sample board. On the south face of this are shown electric street railway goods manufactured by the company, including trolley hangers, clamps, bridge hangers, bracket hangers cross-overs, pull-offs, single and double; anchor plates, strain insulators, adjustable switches, wire tighteners, trolley connectors, etc., all the design and manufacture of the Ansonia company. The insulation used in the railway specialties is of a high grade, hard rubber composition.

On the north side of this board are the Wirt specialties, the invention of Mr. Chas. Wirt, the electrician of the Ansonia company. Among these may be mentioned the W. W. lightning arresters, Wirt brushes, built of metals of high and low resistance, sandwiched together, and which, it is claimed, will last longer and cause less sparking than ordinary brushes, and the direct reading Wirt electricity meter for direct currents.

Between the last two boards mentioned a space has been railed off and comfortably furnished for lounging purposes. Here chairs and a table are furnished and The Electrical World and other live papers of the day are kept on file for the use of visitors.

THE EAST PAVILION.

The third pavilion, which lies to the east, is also octagonal in shape as was that to the west. This is devoted entirely to the display of the American Electric Heating Corporation, of No. 274 Purchase street, Boston, This is the most interesting display for the ladies, and has wisely been placed in charge of a lady who is thoroughly conversant with the utensils displayed, and who will be found always ready to inform and instruct inquirers.

Miss Helen Louise Johnson, the editor of "Table Talk," has charge of the electrical kitchen. Here are found the things of chief interest for the housekeeper. On a long table in the centre of the booth is the electrical oven, illuminated by four electric lights and heated by nine plates. On Tuesdays, Thursdays and Saturdays at 11 a. m. lectures are given on the practical uses of all the electrical cooking utensils, but cooking is in progress during most of the day. In cooking in the electrical oven not only is there less loss by weight, but much time is gained. Not only can the housekeeper have her heat when she wants it, but she can have it exactly where she wants it. The oven roasts most beautifully, but no better than it bakes cake, bread and other dishes made in the kitchen. On a table at the front of the booth is a switchboard to which are attached cooking utensils, chafing-dish, stew pan, tea kettle, coffee pots, broilers, griddles and all the paraphernalia necessary for a first-class kitchen. Here water boils in thin glass dishes upon a disc where the heat can be regulated at will. Welsh rarebits are made in a chafing-dish. Ironing is done and other practical exhibitions are given of what may be done with electricity as fuel. On another table is a collection of irons of various kinds, such as sad irons, goose irons, polishing irons, all made so that they can be attached to the common electric light current and used at will. Not the most unattractive, however, on this table to the ladies is a pair of curling irons heated by electricity. On still another table are found articles other than cooking utensils necessary for housekeeping, viz, glue pots, wash boilers and a heating apparatus attached to a boiler for the purpose of heating water when the old-fashioned range has been done away with. Elsewhere in the booth are to be found car heaters of all descriptions and portable stoves, electric radiators, etc. The electric car heaters are so made that they can be placed under the seat, being 26 inches long and four inches high. They consume in cold weather a total of six amperes as a maximum and three amperes as a minimum, and in mild weather five amperes maximum and 2½ amperes minimum on a 500-volt circuit.

The house and office radiators are, perhaps, more interesting to the housekeeper. The smaller radiators, looking like foot stoves, take up but very little space are attractive looking and heat an ordinary size room in a remarkably short space of time. With the small disc heaters a very large amount of work can be done. On these water can be boiled, coffee made, eggs fried or a cup of tea merely kept warm if so desired, but nothing so generally attracts the housekeeper as the big oven in front of which, on a small table, is displayed daily a roast, a chicken or a turkey most beautifully roasted by the big oven in a marvelously short space of time. It takes two hours for a 16-pound roast of beef to be cooked to a turn, and absolutely no basting is required, and a steak can be broiled in four minutes. Turning on the current for 15 minutes will make the oven quite as hot as desired, as shown by the thermometer on the door of the oven. Put in your turkey, throw off the current, go to church and when you get home that part of your dinner is ready and cooked as well as if you had stayed and watched it every minute. The oven is practically airtight, so that there is no escape of heat. When heated to a certain degree it will stay there for a long time unless means is provided for its escape. By the construction of the oven the heat is even and uniform throughout. Every bit of cooking done in the Minnesota Club Hall at St. Paul is done by electricity; also all that done on the whaleback "Christopher Columbus." The electric ovens are made of Russia iron, lined with wood and asbestos, preventing almost absolutely the radiation of heat in the rom. The heating plates are so placed that the heat can be applied either from below or above or from both at the same time. There are three glass doors in the oven, through which can be viewed the progress of events.

THE ELECTRIC ELEVATOR.

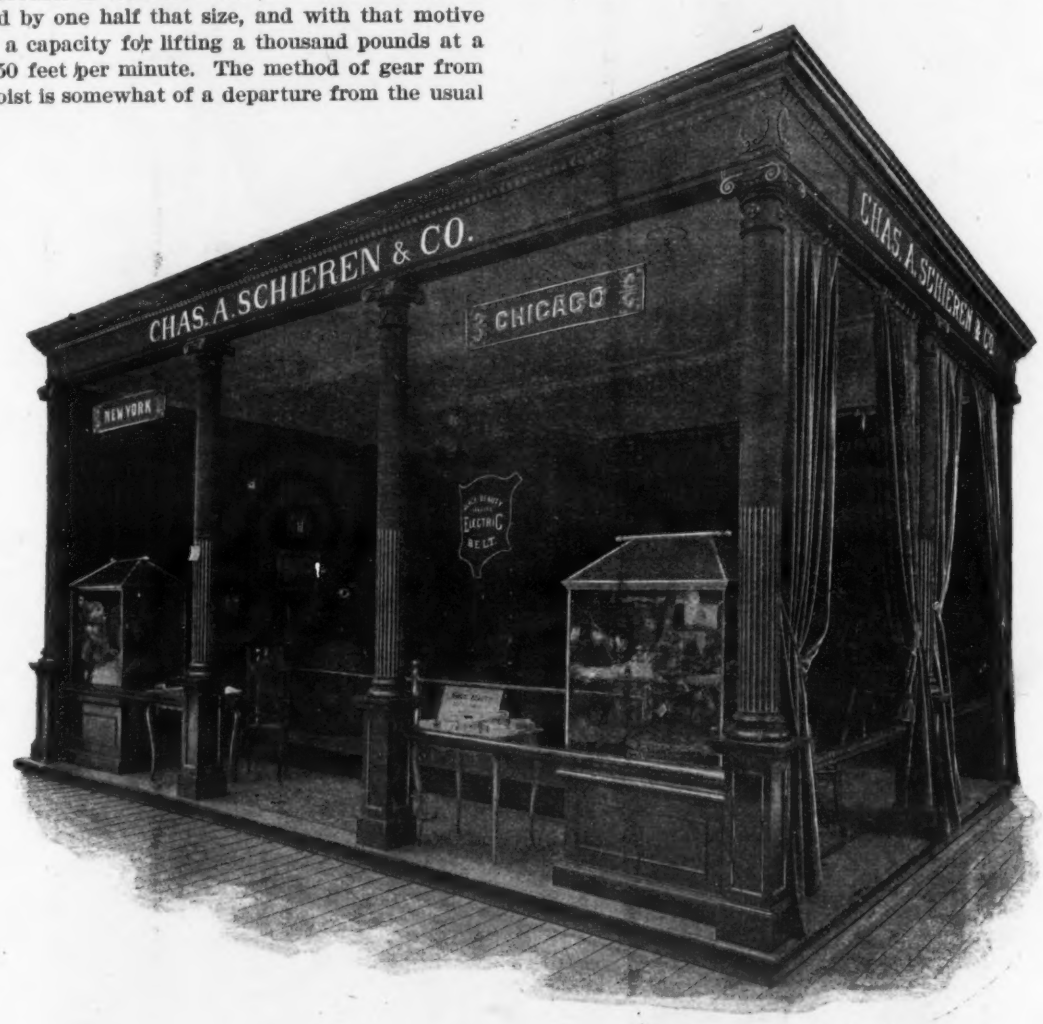
Perhaps that portion of the exhibit which is most highly appreciated by the public at large is the electrical elevator at the north end of the building, which carries visitors from the ground to the gallery floor free of charge. This was put in by the Frisbie Elevator and Manufacturing Company, of New Haven, Conn., whose agents in the west the Ansonia company are. This is operated by a 10-h. p. Crocker & Wheeler motor, but was intended to be operated by one half that size, and with that motive power has a capacity for lifting a thousand pounds at a speed of 150 feet per minute. The method of gear from motor to hoist is somewhat of a departure from the usual one, in that the motor itself is never reversed, but is kept in continuous operation in the one direction. The reversal is effected, however, by a double friction clutch, which when thrown in different directions takes on to opposite sides of the motor driving pulley. From these clutches the winding drum is operated by means of a worm gear which is driven in one or the other direction by means of a belt, according as one or the other clutch is engaged. The usual speed of the elevator is 150 feet per minute. Should for any reason this speed be exceeded, a centrifugal governor on the drum mechanism will instantly bring the hoist to a standstill. Should the cables break, a ratchet arrangement on the drum mechanism is also thrown into gear, which at once stops the driving machinery. On the car itself is another governor intended as a safeguard against dropping of the car. This will permit the car to descend at a safe rate of speed, but should this be exceeded by the breaking of the cable or otherwise, it throws out a clutch which engages in the guides on either side of the car, and arrests its descent at once. The action of these various safety devices is easily shown, and the obliging gentleman in charge takes pleasure in showing the same to visitors feeling enough interest in the subject to inquire.

Taken as a whole, the display of the Ansonia Electric Company is a very comprehensive one, and well deserving of the praise and appreciation which it receives on all sides. The commanding position which it occupies and the fine view which is obtained from it of the Electricity Building—the finest to be had within the enclosure—together with its proximity to the restaurants, and the facility of access by elevator as well as the attractiveness of the display itself, have caused it to be visited by perhaps more people than any of the other exhibits in the gallery.

The World's Fair Exhibits of Charles A. Schieren & Co.

To visitors to the Centennial and Paris expositions the name of Chas. A. Schieren & Co. must be familiar. Their exibits at the various expositions have attracted much attention and have been appreciated by the juries of award, as shown by the various diplomas and medals received.

Their exhibits at the World's Columbian Exposition are unique in design, and the construction of the booth, Section D, Space 3, Electricity Building, is worthy of a careful inspection. The method of constructing booths and pavilions of link belting has been studied with care, and some very artistic combinations have been produced in these exhibits which display to good advantage the construction and general qualities of the leather and the finished belts. The firm has quite outdone itself in this respect in the booth on the east side of the Electricity Building. A classic structure has been erected with four square supporting columns made of the link belt, using black links for the ornamental figures and the Greek scroll around the cornice. The columns are surmounted by small pyramids of belting and adorned with the Spanish colors and American flags. The huge bull's head, with graceful and wide-spreading horns, which serves also as a trademark, is erected directly over the entrance to the pavilion, and, as the horns are each tipped with an incandescent bulb, the effect, joined with that of the light from the other lamps in each panel, is pleasing in the extreme.



A VIEW OF THE SCHIEREN BELT EXHIBIT.

The interior of the booth is provided with chairs, tables and a showcase containing numerous curiosities in belting, among which might be mentioned several old styles of belt joints; one made in 1830 is laced and riveted without cement, another of 1840 riveted and sewed, and various old style English joints both sewed and riveted. Several pieces of belting are shown constructed of narrow strips of leather laid side by side on edge and fastened together with steel bolts. Other styles of joints are exhibited: the old laced joint, the joint made by fine wire lacing and the cement joint. Over this case hangs a frame constructed of link belting in which are contained the various medals received by them for the superiority of their product.

At the left, surrounded by a brass rail, is the exhibit of link belts by the American Leather Link Belt Company. It contains the diploma and bronze medal received at the Paris Exposition of 1889 and various coils of the belt. One large roll contains 100 feet of 36-inch belt one inch thick; and others of 12, 11, 10 and 9 inch belt, all being eleven-sixteenths of an inch thick and used for dynamo work, are shown. Other coils fill out the geometric figures formed by those mentioned.

On the opposite side of the pavilion is the exhibit of perforated and electric belt, the several smaller rolls being grouped tastefully about one large roll consisting of a "Zulu" electric belt 72 inches wide. A roll of 14-inch perforated electric, one of 18 inch and another of 16-inch, are also shown. A photograph of the New York factory at 41-51 Ferry street rests against this exhibit.

In Section F, Block 27, Machinery Hall, Schieren & Co. have another very fine display. A large square pavilion of ebonized wood, touched out with gold leaf, and gracefully hung with linen velour curtains of old rose color,

contains among others a roll so large that one doubts if the wheel has yet been built that will support it. This is a three-ply belt, 200 ft. long and 96 in. wide, and required the hides of 450 large steers for its construction. It weighs over two and a half tons. Grouped about it in graceful figures are rolls of the electric and perforated belt similar to those described in the exhibit in the Electricity Building. In a showcase at the left are samples of the company's patent round and twisted belting, and in another case at the right are exhibited belt lacings both in rolls and in bunches, tipped and plain. Belt dressing and coils of rawhide rope are also shown in the latter case. The names of the four principal offices of the company at New York, Chicago, Boston and Philadelphia are displayed on tasteful signs on the front and back of this pavilion. Two diplomas received by the company at the Centennial and at Paris in 1889 adorn the walls.

While the exhibit of belting at the Fair is large, Messrs. Chas. A. Schieren & Co. can be said to have held their own in all ways and may well be proud of the display. These pavilions do not contain all the belts of the firm at the Exposition. In Machinery Hall and the Electricity Building may be seen the Schieren belts in use on many of the various machines. Nearly all of the all-black belts in use at the Fair are of their make, and they have an aggregate of 60 belts two and three ply at the World's Fair in actual use there, driving dynamos and generators, ranging from

AN ATTRACTIVE EXHIBIT OF LINK BELTS.

72 inches to 12 inches in width. The contracts from the Columbian Exposition Company, amounting to over $8,000, are shown at the Chicago office of the company.

Practical Aspects of Low Frequency Electrical Resonance.*

BY M. I. PUPIN.

A large part of the subject of the following discourse was discussed by me, but in a different way, in three papers.† The method which I have adopted in the following discussion seemed preferable to the mathematical method which I followed in those papers. It is probably just as exact, and certainly a much clearer way of viewing the variable flow of electricity, especially those features of it which have a more or less direct practical bearing.

1. *On the Natural Period of an Electrical Circuit.*—An electrical circuit possessing self-induction and capacity behaves in a great many respects as a body does in consequence of its inertia and elasticity. The fundamental reason for this analogy is simply this: The electromagnetic energy of a coil through which a current flows has all the characteristic properties of the kinetic energy of a moving body, whereas the energy of the static charge of a condenser has all the characteristic properties of the potential energy of a strained elastic body. If the neutral state of such an electrical circuit is disturbed, it will return to it again after performing a certain number of oscillations about the position of its neutral state. But a return to the neutral state is impossible until the energy which is spent upon the circuit to disturb its neutral state has left the circuit, or, to use a more technical expression, until the energy has been dissipated or given off to some other circuit. The two principal causes which produce dissipation and compel the circuit to return to its neutral state again are frictional resistances and radiation. Just as in the case of vibrating bodies, so also in the case of electrical oscillations—losses due to radiation, especially when no other electrical circuits are near, are exceedingly small when the oscillations are slow. In Herzian oscillations they are quite considerable. In oscillations of the Tesla frequency they are probably not negligible. My remarks refer to electrical oscillations of long period; therefore, losses due to frictional resistances are the only losses which I shall consider. Consider now an electrical circuit consisting of a coil A, and a condenser B (Fig. 1) in series with it. It is a circuit with localized self-induction and capacity. I trust that my discussion will lose as little in its generality as it will in practical bearing if I confine it to such circuits only. Let a sudden electrical impulse disturb the neutral state of this circuit: electrical oscillations will result. These oscillations follow laws practically identical with the laws of the motion of a slowly vibrating body. Their period is constant, as we all know, and it is in general completely determined by the electromagnetic moment of inertia and the dielectric elasticity of the circuit; that is, by its coefficient of self-induction and its capacity. When, however, frictional losses due to ohmic resistance, magnetic and dielectric hysteresis are large, then the period of this circuit is no longer defined by the self-

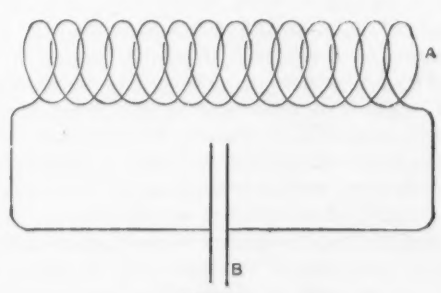


FIG. 1.

induction and capacity alone, but it is also influenced by these frictional losses.

When ohmic resistance and hysteresis losses are small enough, then the natural period of the circuit is given by the well-known formula

$$T = \frac{2\pi}{10^8}\sqrt{L\,C},$$

where T is the natural period of the circuit in seconds, L its coefficient of self-induction in henrys, and C its capacity in microfarads. For instance, a large Bell telephone, whose coefficient of self-induction is 0.5 henry when connected in series to a condenser of one microfarad capacity, will have a natural period of very nearly $\frac{1}{225}$ second, that is to say, an electrical disturbance would set up oscillations in it, 225 of which would take place in one second. If a permanent magnet were brought into the vicinity of the telephone coil and then suddenly

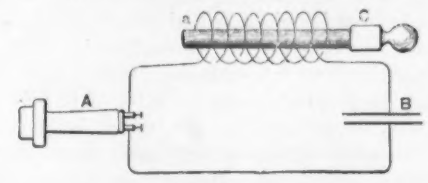


FIG. 3.

removed, the telephone would sing a note whose pitch would be a little below the well-known note C. But it would not sing it very long. For since the ohmic resistance is 100 ohms these oscillations would disappear almost entirely after 10 complete oscillations, somewhat in the manner represented in diagram, Fig. 2, that is to say, the telephone would sing only during about $\frac{1}{22}$ part of a second. By diminishing the resistance we could prolong its song. But diminish the resistance as much as you please, the pitch of the note of the telephone will remain the same, because, as I said, the natural period of the telephone circuit just described is within wide limits independent of the ohmic resistance.

2. *On the Tuning of an Electrical Circuit.*—To change the note, say to make it higher, it would be necessary to diminish the capacity of the condenser. When a piano tuner wishes to raise the pitch of a piano string he gives it more tension; so in tuning an electrical circuit, in order to change its pitch, it is necessary to change its electrical elasticity, that is, its capacity. But there are other ways of tuning an electrical circuit, just as there are different ways of tuning musical instruments. Consider a reed pipe, say a clarionet. The musician places a little bit of wax on the reed. When the instrument is too low in pitch he takes off some of the wax, so to diminish the moment of inertia of the reed, and when the pitch of the instrument is too high, he sticks on more wax so as to increase the moment of inertia. At any rate, this used to be the method of old-fashioned country musicians. And so it is in tuning an electrical circuit. Instead of varying its electrical elasticity, that is, its capacity, we can vary its electromagnetic moment of inertia, that is to say, its coefficient of self-induction. To show how this may be done in the telephone circuit just mentioned, insert into this circuit a small coil, a (Fig. 3), an auxiliary coil, with a removable iron core c made up of very fine iron wire. In doing this we do exactly what the country musician does when he puts wax on the reed of his clarionet. If the electrical pitch of the circuit does not suit, say it is too high, then simply put on more electromagnet wax, that is to say, insert the iron core and move it back and forth until the correct position is found, which will give the correct electrical moment of inertia, that is to say, the correct coefficient of self-induction. This is, briefly stated, what I mean by the expression "tuning an electrical circuit." From the simple expression given above for the natural period of an electrical circuit, it is evident that the tuning of an electrical circuit, if not simpler, is certainly quite as simple a process as the tuning of a musical instrument.

(To be continued.)

*A lecture delivered at the Tenth General Meeting of the American Institute of Electrical Engineers, Columbia College, New York, May 17, 1893.

† "American Journal of Science," April, May and June, 1893.]

An Unusual Static Phenomenon.

Mr. B. B. James sends us the following interesting account of an unusual static phenomenon related to him by an intelligent workman who has been engaged for 15 years in electric bell and gaslighting work in New York and Boston. Having been sent to a church in the neighborhood of Boston to repair a static electric gaslighting plant, he found that one circuit on a chandelier had a leak; leaving a helper to turn the static machine, he went into the attic to find the trouble. The attic was left dark in order that a spark might be detected, and the usual snapping noise was heard, but instead of the usual flash-

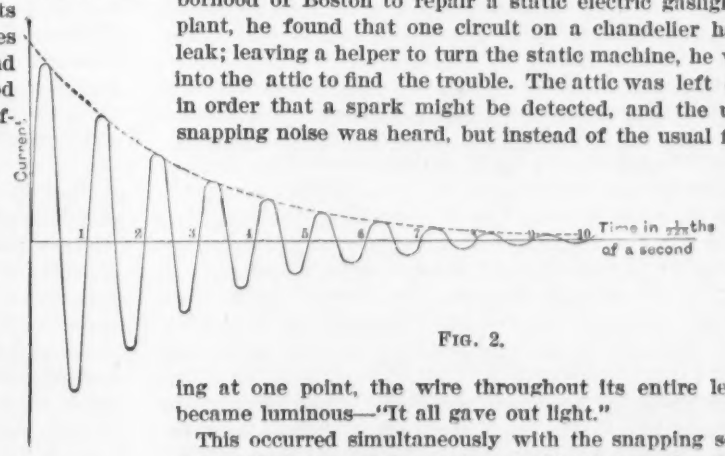


FIG. 2.

ing at one point, the wire throughout its entire length became luminous—"It all gave out light."

This occurred simultaneously with the snapping sound of the discharge. I do not know of having read or heard of a similar case. Although it is intelligible enough, it is a queer coincidence that the resistance capacity, etc., of the line should be such as to give the requisite frequency. The workman scouted the idea that he could have been deceived by the discharges and the diffused light. He had, he said, been in similar places scores of times and never saw "anything like that" before or since.

THE ELECTRICAL WORLD'S DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE.

(Compiled from the principal foreign electrical journals.)
BY CARL HERING.

ELECTRO-PHYSICS.

High Frequency Currents.—Mr. Rimington, in the Lond. "Elec. Rev.," referring to a recent statement of Dr. Jones that a Leyden jar discharge through the human body is oscillatory, states that in general this is incorrect, for to obtain oscillations 4 L must be greater than $K R^2$; in a small pint jar, for instance, K = .0012 microfarad, and supposing the resistance of the human body to be 300 ohms, then the self-induction in the circuit must be greater than the .000027 henry, while the self-induction of the human body and the spark gap would be much less than this; with a jar of greater capacity the case would be still worse; referring to the apparent increase of resistance, due to high frequency currents, he says that if it be worked out by Lord Kelvin's formula for a 5-c p. 100-volt lamp for a frequency of about 400,000, it will be found that there is practically no increase in resistance, so that we must look to other causes for the incandescence of the filament; the small increase of resistance thus found is due to the very small cross-section of the filament.

Electro-Photography.—The Lond. "Elec. Eng.," July 7, in a note mentions an alleged discovery of Mr. Packey, described in the "English Mechanic." He claims to have photographed the "electric rays" of the spectrum by causing an electric current to pass over the photographic negative during exposure, obtaining thereby a secondary spectrum, the ordinary spectrum being slightly deflected by the urrent the second spectrum is faint and contains the rays of the ultra-violet portion: these he calls the electrical spectrum, stating that the action of the current tends to deflect all the rays due to electrical energy, and thereby isolates them from the rays due to chemical energy, the deflection being always in the direction parallel to the current. The idea appears to be that if there "is any definitely electrical action in photography it will be deflected by a steady current at right angles; there would then be a sifting of the various rays and comparison might give extra data for the study of star distances." A short description is given of how this experiment is conducted.

Electro-Chemical Actinometer.—Mr. Rigolot before the French societies showed that it was possible to make a sensitive actinometer by using an electrode of oxide of copper in a chloride, bromide or iodide solution; the E. M. F. produced by the light rays may be increased by coloring the oxide with a thin film of some coloring material, such as eosin, sofranine, green malachite, soluble blue, etc.; the plates, after having been dipped in the coloring matter, may be washed and dried and even rubbed with filter paper without losing their sensitiveness; the increase of the E. M. F. depends on the coloring matter employed. Some figures regarding the spectrum are found in the Lond. "Elec.," July 7.

Polarization of Platinum Electrodes in Sulphuric Acid.—The Lond. "Elec. Eng.," July 7, reprints a Royal Society paper by Mr. Henderson, giving the results of some tests made at the instigation of Lord Kelvin. The paper shows the manner in which the tests were made and gives the results in a table. All the results point to the polarization being constant with large electrodes, being independent of the strength of the solution and of the intensity of the current; the mean of all the values of the polarization was 2.09 volts.

UNITS, MEASUREMENTS, INSTRUMENTS.

Measurement of Internal Resistance of Primary Batteries Which Polarize.—In an interesting article by Mr. Rimington, in the Lond. "Elec.," July 7, he calls attention to the fact that in the usual methods of measuring the internal resistance of a battery the polarization produces an error which may become very great; he calculates the probable error, and shows that in a certain case it may be as high as 21 per cent. In order to eliminate the effect of polarization, which becomes a serious one in all cells like the Leclanché, or the dry cells, in which case the measured internal resistance may be double its real value; in the ordinary methods he found that the best results were obtained by circuiting the battery through a resistance about four to ssix time its internal resistance until the difference of potential had attained a fairly constant value, then breaking the circuit and instantly measuring the difference of potential on open circuit. The best method of doing this is shown in Fig. 1, in which K is a condenser and r is the resistance; key 2 is clamped down, and the difference of potential measured by depressing key 1, and then releasing it, thus allowing the condenser to discharge through the galvanometer G; when a constant throw d is obtained, key 1 should be depressed, key 2 released, and immediately afterwards key 1 released, the throw D will then be that due to the E. M. F. of the battery when polarized; the internal resistance of the battery is then equal to $r(D-d)\div d$; the best value of r is from four to six times the internal resistance, a larger value being even better, provided the difference between D and d be sufficiently great. If a voltmeter is used instead of a galvanometer and a condenser, it should be as dead beat as possible and several readings should be taken in succession, the times being carefully noted, starting with the breaking of the circuit; these readings are then plotted and a curve drawn through them, which, if continued back to the instant of breaking the circuit will give the reading at that instant (this assumes that the curve does not change its curvature materially in the very beginning, an assumption which it may not be safe to rely upon); it is found necessary to keep

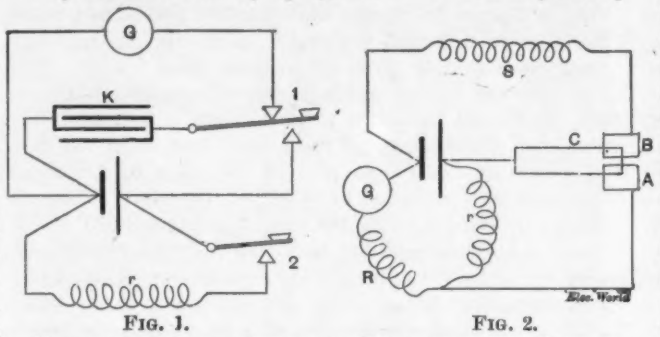


Fig. 1.

Fig. 2.

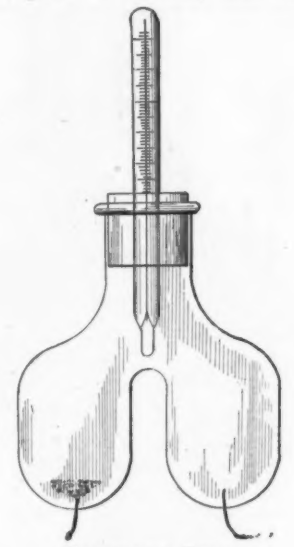
Measurement of Internal Resistance of Primary Batteries.

the circuit closed for many minutes through r before the polarization has assumed a fairly constant value. He gives another method, shown in Fig. 2, by which the polarization can be completely eliminated; it is a modification of Lord Kelvin's well known test; C is a movable lever making contact absolutely simultaneously with the two contact pieces A and B when depressed, thus putting on the shunt and cutting out r at the same instant; r is first adjusted until, on pressing the key, a movement of increase is obtained, which will be followed immediately by one in the direction of decrease, due to polarization; then gradually reduce r until on depressing the key there is just no movement of increase, while if r is very slightly increased the movement of increase is again visible; this eliminates polarization. The galvanometer is used with a false zero, the index being brought to the scale by a directing magnet, or by another coil carrying a current; r should be large and S small, but not too small, the best value being probably when it is equal to S; the objection to this method is the difficulty in making the key. The best and most accurate method, he states, is Mance's bridge method; but if the cell polarizes, the effect of polarization must be eliminated by the above method.

Holden-D'Arsonval Galvanometer.—The Lond. "Elec.," July 7, publishes a well illustrated description of this galvanometer as modified by Major Holden; the objects of his improvements are mainly to facilitate removing the coil and replacing it by another one of different resistance, also to adapting it for alternating currents. In general, the different coils with their fixed iron cores and the supports are made in the form of one complete piece, which is readily removed as a whole from the galvanometer; it is claimed that the constant of each frame with its coil remains unaltered; the coils are suspended by fine strips of flattened phosphorus bronze; one feature is that in replacing a frame by another, their positions are always precisely the same. The 500-turn coil with 10 megohms added gives a deflection of 1 millimetre for 1 volt at a scale distance of 2 metres; special care is taken to have the field as uniform as possible, in order to make the scale as nearly as possible proportional. For measuring alternating currents the same frame is used, but instead of the coil a fine vertical wire of platinum-iridium is stretched from the upper to the lower support; in front of this another wire, not in circuit, is stretched, and is given a slight torsion; a small mirror is attached to this torsion wire, and is connected at one of its outer edges with the platinum-iridium wire by means of a silk thread; the torsion tends to turn the mirror in one direction, while the contraction of the platinum-iridium wire, to whose middle point the silk thread is attached, tends to turn the mirror in the opposite direction, the instrument forming a sort of modified hot wire voltmeter, the magnets in this case taking no part in the action. In another modification, also for measuring alternating currents, the coil is made of one turn, forming a short-circuited thermopile, one junction of which lies near the heated wire through which the alternating current passes, the coil itself being suspended as in the usual D'Arsonval instrument; the heating of the wire causes a current to flow in this short-circuited coil, which current is then measured by the deflection of the coil; no data are given for judging the value of this improvement, nor is it stated whether the deflection is proportional to the alternating current.

Clark Standard Cell.—Dr. Lindeck (of the German Imperial Institute), in "L'Elec.," June 24, describes the methods used in the Institute for comparing the E. M. F. of this cell with the difference of potential at the terminals of a standard resistance, the current being measured by a silver voltameter. A diagram of the connections is given; two voltameters are used in series controlling each other, the current is about .5 ampère and the resistance about 3 ohms, the former being regulated so that the difference of potential is exactly equal to that of the Clark cell (in that diagram a connection is inadvertently omitted between the 3-ohm coil and the wire directly below it); the sensitiveness is such that a hundred-thousandth of a volt can readily be detected; the mean value thus found was 1.4379 volt at 15 degrees. He states that the E. M. F. of this cell is established beyond any doubt within 0.1 per cent. He also gives a diagram of the connections for comparing two similar cells with each other; the two cells are connected in opposition through the galvanometer, their difference being balanced by sliding contacts on a potentiometer wire through which a constant current is flowing, the current being maintained constant by means of a third Clark cell and the same galvanometer; by this means it is possible to measure a difference of .00001 volt, 1 millimetre corresponding to .00002 volt; cells of the H type were found to differ rarely by as much as .0001 or .0002 volt; in the same way the temperature coefficients are determined. He mentions the Carhart and Weston cells (both of which have been described in these columns), and concludes that in the Clark cell we have a standard of E. M. F. the exactness of which is amply sufficient for all purposes.

The Lond. "Elec.," July 7, reprints an article from the German by Dr. Kahle, based on the experiences of the German Imperial Institute. The main object was to make a cell which is easily reproduced, is portable and adjusts itself readily to changes of temperature. The cell is shown in the adjoining cut; the instructions concerning chemicals are the same as those recommended by the Board of Trade; its E. M. F. is 1.438 at 15 degrees, which decreases between 10 and 25 degrees by .00115 volt per increase of 1 degree. The diameter of the branches should be at least 2 centimetres, and their length 3 centimetres, the neck being at least 2 centimetres long; if not for the purpose of being transportable, an amalgam of 90 parts of mercury and 10 parts of zinc



Standard Cell.

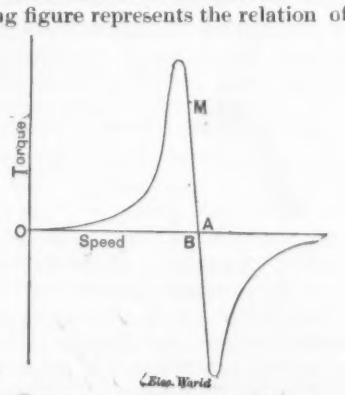
is made, it being fluid when hot and solid when cold; the paste is poured 1 centimetre deep over the mercury, after which both are covered with a layer 1 centimetre deep of zinc sulphate crystals, the vessel being then filled with a concentrated zinc sulphate solution, leaving only a slight air bubble to prevent bursting; if it is to be portable, a circular electrolytically amalgamated piece of platinum foil about 1 centimetre long and 1 millimetre thick takes the place of the mercury and is firmly attached to the platinum wire. He also describes at some length the preparation of the material and the detail of construction.

Ayrton & Mather Galvanometer.—The Lond. "Elec. Eng.," July 7, in referring to this galvanometer, gives a brief description.

Electrical Laboratory in Paris.—"L'Elec.," July 1, gives a short description of the new laboratory recently opened in Paris for conducting electrical tests; although not under government control it is practically equivalent to a government laboratory.

DYNAMOS, MOTORS AND TRANSFORMERS.

Theory of the Thomson (Brown) Non-Synchronous Alternating Current Motor.—Dr. Sahulka, in the "Elek. Zeit.," July 7, gives, at some length, a theory of the action of this motor, and draws some conclusions from the same. The accompanying figure represents the relation of the torque



Theory of Thomson Motor.

and the speed as obtained from his equations, showing very clearly how the torque increases as the speed increases; it is zero when the motor is at rest, increasing but very slowly at first until the speed approaches synchronism, when it suddenly becomes a maximum, then falls rapidly and becomes negative; the point marked A represents the synchronous speed; if the motor is run normally at a speed corresponding to O B, the torque will be B M, in which case, if the load be suddenly increased, the torque will increase, and therefore the speed will again recover itself, or, in other words, it will tend to be self-regulating to a certain extent. If, however, the speed falls below the point corresponding to the maximum torque, the torque will fall instead of increasing, and the motor will therefore come to rest.

ARC AND INCANDESCENT LAMPS.

Incandescent Lamp.—The Lond. "Elec.," July 7, contains an abstract from a book by Mr. Gilbert S. Ram, about to be published, in which a number of interesting points are discussed. He states that at present carbon is about the only substance that can be used, and gives his reasons; among other experiments he tried coating both platinum and carbon with oxides, such as alumina, magnesia, lime, etc., but always found that owing to the different coefficients of expansion the oxides scale off. In the arc lamp it appears that everything volatilizes, and it therefore appears futile to attempt to increase the durability of arc lamp carbons by the addition of any foreign substance; he believes, however, that it may be possible that some substance other than carbon may be found, as some oxide or mineral which is stable at temperatures even higher than that of the arc, if there is no carbon present; the difficulty in the way being the electrical conductivity; some of them may consent to conduct sufficiently when subjected to a very high E. M. F.; slate pencils, for instance, have been used successfully in arc lamps in place of carbon. In incandescent lamps great improvements, however, may yet be looked for in the carbon itself; the temperature in an incandescent lamp is probably lower than that in the arc, but the temperature of volatilization of carbon in vacuo is likely to be much less than at atmospheric pressure; but long before this temperature is reached there is another effect, namely, the dissociation of the filament and its deposition on the globe, which puts a far lower limit upon the practical temperature as its action begins at a comparatively low temperature, increasing rapidly at high temperature; improvements must be looked for in this direction; the best carbon is that which at the highest possible temperature disintegrates at the lowest rate. It has been supposed that the smaller the surface the better, but he thinks the reverse is usually the case, the filament with the smallest emissivity being generally the best; it implies a polished white surface, while a high emissivity generally means a dead black surface and a softer carbon; the size of the bulb should not be determined by the length of the filament so much as by the candle power. The article is to be continued.

Arc Lights.—Mr. Guy, in his serial in the Lond. "Elec. Eng.," July 7, discusses from a theoretical point of view the effects of hanging arc lights at different heights; the results are not, however, of any particular interest. He also discusses the consumption of carbon in arc lamps.

RAILWAYS.

Electric Traction.—The Lond. "Elec. Eng.," July 7, publishes the proceedings of the annual meeting of the Tramways Institute. It appears from this that at present there are 33 miles of electric tramways in the United Kingdom. Mr. Epstein read a paper on accumulator traction, in which data are given about the Birmingham road (see Digest of last week); in some additional figures he states that 24 cars would cost $60,000 for the accumulator system as compared with $120,000 for the trolley system and $180,000 for the conduit system; regarding the working cost, he said that it was more economical at the station, owing to the constant load; regarding the supervision, he states that of the 12 sets of cells that had been in use since December, 6 sets had been cleaned out only once, so as to get rid of the mud, and that this was the only expense in their supervision; out of the 10,000 plates in use not a single one had been repaired; he estimates that it would cost $5,000 per car to equip a tramway, not including the depot and the tram line; he is ready to undertake to maintain the accumulators at a cost of two cents per car mile. A paper by Freund on lighting omnibuses is noticed elsewhere under this heading.

Electric Conduit Road.—The Lond. "Elec.," July 7, states that the conduit road in Budapest, which is at present by far the largest and most successful road of this kind, carried 14,000,000 passengers in 1892, as against 8,500,000 in 1891; the receipts increased nearly 50 per cent., a dividend of 7 per cent. was paid, leaving over $10,000 as a reserve; the remaining capital is to be issued at 50 per cent. premium. (The success of this road, which has so long been doubted by many, seems now to be well established.)

The Telephone and Electrical Traction.—The English journals of July 7 continue the report of the Parliamentary proceedings regarding the electric powers protection clauses.

INSTALLATIONS, CENTRAL STATIONS, SYSTEMS, ETC.

Lighting Omnibuses.—The Lond. "Elec. Eng.," July 7, gives an abstract of a paper by Mr. Freund, in which he describes the apparatus used in the London omnibuses. It consists of a Bristol battery, weighing about eight pounds (whether this is per cell or per battery is not clear; presumably it is per cell), consisting of six cells connected in series; the plates have no metallic frames, consisting almost entirely of active material. Such a battery will run a 5 c. p. lamp for six hours. The battery and lamp are described in detail. The lamps are said to last from three to four months. The charging takes from three to seven hours, and the acid is renewed every two weeks. An estimate is given for lighting 200 omnibuses, showing the first cost to be $3,875, and the cost of maintenance $2,375. Editorially, the "Elec. Eng." states that these figures are misleading, and are a mere estimate, as distinguished from the actual figures.

Train Lighting.—According to the Lond. "Elec. Eng." a French railroad recently tried for a few months the De Meritens primary battery, made of a plate of zinc, of two platinized lead plates pierced with holes, in a solution of four parts of water and one part sulphuric acid; a car carried two boxes of nine cells each; each compartment has two lamps; the 18 cells weigh 264 pounds and will light three lamps for 48 hours at 10 volts and 1.6 ampères; the experiments have been abandoned.

Gas Power.—The Lond. "Elec. Eng.," July 7, in an editorial, mentions a recent paper of Mr. Dowson, from which it appears that in a plant in Dessau it was found that there was an actual saving of 50 per cent. in favor of burning the gas in the engine, instead of in the burners.

Gas Engine Generators.—The Lond. "Elec. Eng.," July 7, mentions that in the station in Lille, in France, three gas engines of about 110 h. p. are to be used in connection with a battery of accumulators of 50 kilowatts output.

Central Stations and Gas Power Plant.—"Ind. and Iron," July 7, gives a short illustrated description of a very small central station at Carignan, the engine being a 60-h. p. gas motor run with a poor quality of coal and consuming 1.5 pounds per hour.

Combined Destructor and Electric Lighting Station.—"Ind. and Iron," July 7, concludes its description of the St. Pancras station, the present installment being devoted to a detailed description of the suggested destructor plant for utilizing the city refuse in place of coal; considerable data of interest are given.

Central Station, Altona (Germany).—The "Elek. Zeit.," July 7, publishes at some length a very well illustrated description of this station, in which the three wire system is used with continuous currents and accumulators, one feature being the use of an uninsulated neutral wire, it being the first station (presumably in Germany) in which this has been carried out consistently. Among the illustrations are a large plan and elevation of the station, drawings of the dynamos, the switchboard, as also some well selected views and diagrams of the connections. The station was erected by the firm of Schuckert & Co.

Automatic Accumulator Regulator.—Mr. Gibson in the Lond. "Elec. Rev.," July 7, describes briefly an apparatus for the same purpose as the Trumpy regulator described in the English journals recently.

WIRES, WIRING AND CONDUITS.

Earthing up to Date.—Under this heading the Lond. "Elec. Rev.," July 7, discusses briefly the subject of earthing, and shows by a simple example that the troubles due to leakages through the earth are greatly reduced, if not entirely removed, by connecting permanently one of the wires to the earth; if this is not done it can readily be shown that powerful earth currents may pass from one leakage point to another, while if one of the leads is earthed the faults are localized and the possibility of strong earth currents removed.

A Cheap Earth Connection.—An English journal, "Arms and Explosives," describes an invention of Dr. Mann, in which the connection is made of lengths of stranded cable, the strands of which have been frayed out and distributed in all directions in the earth like a fibrous root.

Aerial Lines.—Mr. Carter, in his serial in the Lond. "Elec. Rev.," July 7, discusses the subject of the supporting of aerial lines, giving formula and data for calculating the distance between poles, the sag, strain, etc., modes of coupling, oil, insulators, etc.

Wiring Rules.—The Lond. "Elec. Rev.," July 7, concludes the publication of the rules adopted by the London supply stations.

ELECTRO-CHEMISTRY.

Guaranteeing Accumulators.—Mr. Leroy, in "L'Elec.," June 10 and 24, discusses the various conditions and the methods used, and concludes that the following plan is the best: In order that the manufacturer may guarantee the battery, a series of apparatus should be installed with the plant, which control the charge and discharge so completely that it is not possible to misuse the battery, the manufacturer being then perfectly safe in assuming a guarantee. To avoid too great a discharge or charge an automatic cut-out should be put into the discharging and another into the charging circuit; fuses are too unreliable, and therefore magnetic cut-outs are recommended; but as these only open the circuit and do not close it again, they are introduced merely as an additional safeguard and are set to a slightly higher value; under normal conditions they should not come into use at all; instead of controlling the current by means of cut-outs he suggests using an automatic regulator which is actuated by the current and which puts resistance into the circuit just sufficient to keep the current down to the maximum; one of these is placed in the charging circuit and one in the discharging circuit; for this purpose the Trumpy regulator, recently described in the English papers, will answer if the shunt coil is replaced by a series coil and other slight modifications; instead of using a few regulator cells which are cut in or switched out of the circuit by a regulator, he thinks it preferable, even considering the economy, not to use them, but to keep all cells in circuit at all times, controlling the voltage by means of resistances actuated automatically; such a regulator could be made cheaply and of simple construction; in order not to overcharge or over-discharge, he suggests using a meter which registers in one direction for the charge and in the other for the discharge, allowance being made in its construction for the ampère-hour efficiency; such a meter will then at all times indicate the ampère-hours left in the battery; in order to avoid over-charging or over-discharging it is almost indispensable to make the meter break the circuit by means of a relay, when either of the two extremes are reached. A diagram is given showing the connections in this arrangement, and he promises in a future article to describe the apparatus.

Theory of Alternate Current Electrolysis.—The Lond. "Elec.," July 7, reprints a paper from the Italian by Dr. Malagoli, in which he discusses the subject from a theoretical standpoint, and deduces a number of conclusions, one of which is, than when electrodes are used with different electrolytes, the quantity of electrolytic product does not follow the laws of Faraday, since the energy in the polarization and depolarization are different. His final conclusion is as follows: "The necessary and sufficient condition of alternate current electrolysis is that the quantity of electricity which passes through the voltameter during a single alternation should be greater than twice that which is necessary to give to the voltameter its maximum polarization. Electrolytic production ceases the moment these two quantities are equal, and the amount of decomposed electrolyte is proportional to the difference of these two quantities."

Gold Ores.—Lond. "Elec. Eng.," July 7, gives a short abstract of a recent paper by Mr. Hannay, in which he spoke of the refractory ores of gold which, now that alluvial deposits are wrought out, constitute the whole future source of gold. Owing to the great difficulty in extracting the gold chemists have always hoped that some new method would be discovered; this, it is claimed, is done by Mr. Hannay's new process, by which, at the cost of a few shillings per ton, he can extract the gold in a few hours, a process which, it is claimed, is a complete solution of the difficulty; one vat is capable of extracting ten to twenty tons of ore in three to four hours, the gold and silver being obtained in a metallic state as an amalgam; tests by the assayer of the Bank of England showed that the degree of refractoriness does not affect the yield by this process.

Electrolytic Production of Zinc.—The Lond. "Elec. Eng.," July 7, mentions a process for converting blende into soluble salts of zinc, and electrolyzing the latter; the cathode is made of zinc and the anode of iron or any other metal not zinc; they are separated by a porous partition; the cathode is surrounded by a solution of a zinc salt and the anode by a solution whose positive component is of a salt of the metal employed as the anode, and whose negative component is of the same acid as that in the zinc salt to be electrolyzed; when the liberated acid forms insoluble salts by combining with the anode the porous partition need not be used.

Silver Plating.—"Ind. and Iron," July 7, continues its article on the silver-plating industry; the present installment is on burnishing and coloring, illustrations being given on the shapes of the most important burnishers used. The article is of a practical nature, and appears to be well written.

MISCELLANEOUS.

Electricity on Ships.—The Lond. "Elec. Rev.," July 7, reprints an abstract of a paper by Mr. Newitt, in which he enumerates the various purposes for which electricity is now used on board ships. Among other things he states that formerly a large number of small lights were used to illuminate the compartments, but that now one-tenth the number of lamps, but of high candle power, were preferred, which not only cheapens the first cost, but lessens the trouble of maintenance. Flash lights for telegraphic connection, he says, have been very much developed; a light is placed at the top of the mast, and is shut off or exposed by means of a movable screen; this was found preferable to switching the current on and off, as the speed of signaling is thereby greatly increased owing to the fact that no time is lost in cooling and reheating the filament; the Morse alphabet is usually adopted. The projector consists of an arc lamp manipulated by hand, the movable screen being in front, and a metal reflector in the rear lamp; such a lamp taking 100 amperes and 80 volts generates a light of 20,000 to 25,000 c. p., and can clearly illuminate an object four miles distant. Another development is in the introduction of electric lights into the sights of guns for use at night; another application is in the use of a lamp with an inclined reflector for examining the interior of a gun, boiler tube, steam pipe, etc.; he also describes the electrical indicators for indicating the position of the helm and for communicating from and to the bridge; primary or secondary batteries, he states, have been used for working these signals, but as the failures which occurred were always traced to the battery a switch has been designed which connects these with the dynamo circuit, and which, in case the dynamo should cease running, connects them to a battery; a telephone has now been introduced which is less costly and, in some cases, more efficient than the ordinary speaking tube; in a recent trial made in a noisy workshop these telephones were found to be more distinct for a distance of eighty yards than the ordinary two inch speaking tube. Regarding motors, he calls attention to the fact that their principal use is in cases where their high speed can be directly utilized; he also describes briefly some applications to slow-moving machinery.

Marking Meat by Electricity.—According to the Lond. "Electrician," June 30, Mr. Manville suggested to a committee of the House of Lords that meat might be marked by a wheel with needles in the circumference, which, when connected with an electric source and passed over the meat, makes a continuous skin-deep mark.

Decision in the Oconto Incandescent Lamp Case.

On Thursday, July 20, Judge Seaman handed down his decision in the case of the Edison Electric Light Company et al. vs. The Electric Manufacturing Company et al., in the United States Circuit Court for the Eastern District of Wisconsin. As was stated in The Electrical World the judge expected to render his decision on Monday, July 17, but on that date announced that it would not be made public until the following Thursday. The preliminary injunction against the Electric Manufacturing Company was granted, and the full text of the opinion is as follows:

This is a motion for a preliminary injunction. The complaint alleges infringement by defendants, manufacturers of electric lamps, at Oconto, Wis., of the second claim of Letters Patent No. 223,898, issued to Thomas A. Edison, Jan. 27, 1880, and adjudged valid, after protracted contest, in the Circuit Court for the Southern District of New York, affirmed by the Circuit Court of Appeals of the Second Circuit. The defendants have answered, the original answer admitting infringement of said second claim, as construed in said decisions, but by an amended answer (allowed at the hearing) take issue upon such infringement, avowedly upon their proposed new showing as to the prior state of the art, through the alleged Goebel invention, and the narrower construction which should thereby be placed upon said second claim; and further setting up prior invention by one Henry Goebel, not litigated in the New York case. For and against the motion, voluminous records, affidavits and depositions, with sundry exhibits are presented, to which reference will be made.

It was shown that litigation in behalf of this patent has been actively carried on since May, 1885, both directly and collaterally; that after obtaining favorable decisions in other cases, wherein issues under this patent were involved, and defending successfully against the Sawyer & Man patent (40 Fed. Rep., 21), judgment was obtained in July, 1891, in its action in the Southern District of New York against the United States Electric Lighting Company, sustaining the second claim of this patent, and decreeing injunction (47 Fed. Rep., 454), which was affirmed by the Circuit Court of Appeals for the Second Circuit in October, 1892 (52 Fed. Rep., 300). The defendant in that case having turned over to the Sawyer & Man Electric Company the business of manufacturing, suit was brought against the latter and injunction granted, and affirmed by the same Circuit Court of Appeals in December, 1892 (53 Fed. Rep., 592).

It further appears that injunctions have been granted against other infringers in this circuit and in various other circuits, without serious contest; and that in the District of Massachusetts, in complainant's suit against the Beacon Vacuum Pump and Electric Company, the motion for preliminary injunction was vigorously contested, upon the grounds presented here, and in an exhaustive opinion handed down by Colt, J., Feb. 18, 1893, the injunction was ordered (54 Fed. Rep., 678). On the other hand, in a suit by complainant against Columbia Incandescent Lamp Company, in the Eastern District of Missouri, upon similar motion and additional affidavits, an opinion was rendered April 21, 1893, by Hallett, J., refusing the injunction if the defendants should give a bond.

All of the records and affidavits before the courts respectively in the Beacon case and in the Columbia case are here, and much additional testimony, that upon the part of defendants, taken since such hearing in rebuttal under an order of this court, being in the form of depositions and with cross-examination of witnesses.

Therefore this court has the benefit of the opinions handed down at those hearings, and the embarrassment as well of deciding here between apparent differences in views as to the measure of proof demanded.

In the opinion in the Beacon case, the rule applicable to this defense against the motion is stated, citing a number of authorities, as follows: "The burden is on the defendant to establish this, and every reasonable doubt must be resolved against him;" also, that "the presumption of novelty is not to be overcome except upon clear and convincing proof." The showing there made is reviewed at length and found insufficient to meet the requirements of the rule.

The opinion in the Columbia case is not yet reported, but in a copy furnished for this hearing the views which control the decision are stated as follows: "There is not the measure of proof demanded by complainants' counsel, who maintain that the court should require proof of the fact beyond reasonable doubt. This degree of certainty is not often attained upon testimony in the form of affidavit when the issue is contested, and it is not reasonable to demand such certainty as to the defense. Complainants must show a clear right in support of a preliminary writ, and a defense which puts the case in doubt is sufficient to defeat the application;" and for its conclusion against the injunction, holds, "It is enough to say that there is a fair preponderance of testimony in support of the Goebel claim."

Decisions of the Supreme Court have settled beyond controversy that for the defense of anticipation and prior use against a patent the proofs must be "clear, satisfactory and beyond a reasonable doubt." The Barbed Wire Patent, 143 U. S., 275, 284; Cantrell vs. Wallick, 117 U. S., 689; Coffin vs. Ogden, 18 Wall., 120; and that has been the constant rule in this circuit. Smith vs. Davis, 34 Fed. Rep., 783; Washburn & Moen Manufacturing Company vs. Haish, 4 Fed. Rep., 900; 10 Biss., 65; American Bell Telephone Company vs. Cushman Telegraph Company, 35 Fed. Rep., 739.

The decisions and text books agree upon the general rule stated in the opinion of Judge Colt (p. 679), that an adjudication of the validity of his patent after *bona fide* contest entitles the complainant to a preliminary injunction, and especially after long and expensive litigation in a suit against other infringers, and that the only question open upon his motion therefor is that of actual infringement by the defendant of the claim so adjudged valid. Other defenses are then reserved to final hearing and injunction issues, as of course in the same court, and by comity in other courts. One exception to this rule is sometimes allowed, and that is where there is clear showing of a meritorious defense, which was not before the court in the original suit, and which, had it entered into consideration, would probably have defeated the patent or claim. It is under this exception that the defendants assert their right to oppose this motion, and their affidavits are directed to proving an invention and use by Henry Goebel prior to that of Edison. Although sundry other claims of priority have been set aside by the court in the course of the litigation, this one was not presented, and the defendants have a right to their day in court for its hearing. The question is whether there is such clear showing of merit for this claim now asserted that the defendants should be relieved from the general rule by denying in their case the usual injunctional order; and the primary inquiry is, what must be the measure of proof demanded? Must it be of the quality and quantity required to defeat the patent at final hearing—"clear, convincing and beyond reasonable doubt," as held by Judge Colt; or will it suffice for denial of the motion that it shows "a defense which puts the case in doubt," as held by Judge Hallett? It is clear that the presumption must be in favor of the patent and that it cannot be overthrown by a mere doubt. I think the true test for proof upon the motion is that it shall be sufficient to raise a presumption that it would have defeated the patent had it been produced at the trial. This would demand, at least, the full measure required to overcome the presumptive force of the patent, and that every reasonable doubt be dissolved against the defense, here as it would be there, as held by Judge Colt. In the eyes of the law, at this stage, the complainants stand upon their rights with their letters patent confirmed after arduous contest, and entitled to preliminary injunctions against infringers; and the defendants must place themselves entirely within the exception to the rule, if they invoke the privileges of that exception, and would deprive the complainants of the fruits of their hard-earned victories. The rule held by Judge Colt will therefore be adopted here, and the following additional authorities are cited as supporting it: Macbeth vs. Braddock Glass Co., 54 Fed. Rep., 173; Accumulator Co. vs. Consolidated Co., 58 Fed. Rep., 795; American Bell Tel. Co. vs. Southern Tel. Co., 34 Fed. Rep., 795; Siebert Cylinder Co. vs. Michigan Co., 34 Fed. Rep., 33; Ladd vs. Cameron, 25 Fed. Rep., 37; Hussey vs. Whitley, 2 Fish., P. C., 120; Jones vs. Merrill, 8 O. G., 401; Potter vs. Fuller, 2 Fish., P. C., 262.

I have examined with care each of the authorities cited in the opinion of Judge Hallett, and others noted by defendants' counsel, but they do not impress me as supporting the rule held in that opinion, or as opposed to the rule pronounced in the cases above cited.

With the adoption of this rule it is not necessary to review in this opinion the affidavits and exhibits which were before the court in Massachusetts, in the Beacon case, as a careful examination has fully satisfied me with the review and criticisms contained in the opinion of Judge Colt, and the conclusions reached by him at that stage. And of the additional evidence introduced at St. Louis, in the Columbia case, it might be sufficient to hold, in accordance with the view stated in the opinion of Judge Hallett, with which I agree, that "there is not the measure of proof demanded" by this rule. Resting upon those conclusions, it would only be necessary to consider the new testimony which has been presented here, and determine whether it has cleared the doubts which have come from the former hearings; but an understanding of the conclusions reached requires for preface a statement of some of the doubts which have been impressed upon my mind by these records.

Edison's discovery was published late in 1879. It promised an incandescent electric lamp which would supply the great want of an operative commercial light, suitable for domestic uses, cheap and practical, and aroused great interest and excitement in commercial and scientific circles. Lighting by electricity had long been an accomplished fact, in arc lamps and various single burners, but the problem which had remained unsolved was a method of subdivision of the light, for which scientists in Europe and America were seeking, and which many of them pronounced impossible, an ignis fatuus. It was the solution of this problem that Edison thus announced. As stated by Mr. Justice Bradley in the McKeesport case, 40 Fed. Rep., pp. 29–31: "This was the real, the grand discovery in the art of electric lighting, without which it could not have become a practical art for the purpose of general use in houses and cities. . . . We think we are not mistaken in saying that but for this discovery electric lighting would never have become a fact."

The invention claimed by Edison was a lamp which is "the embryo of the best lamps now in commercial use." The second claim of his patent here involved described it as follows: "The combination of carbon filaments with a receiver made entirely of glass, and conductors passing through the glass and from which receiver the air is exhausted, for the purpose set forth."

The thread of filament of carbon for a burner was the fundamental discovery to obtain this subdivision of electric light, for by its use he obtained the high resistance which was essential to the multiple arc system, and saved the use of enormous conductors of the electric current, the cost of which was otherwise prohibitive of subdivision. He found that for stability of this thin carbon it was necessary to have a high vacuum, and remove all gases to prevent what he calls "air-washing." This led to the entire glass receiver or chamber for the lamp, and finally to platinum leading-in wires sealed into the glass, because "the co-efficient of expansion of glass and platinum was the same," and the high vacuum would be retained, while iron or copper wires would destroy it. This discovery was therefore in successive steps, and only as essentials for the great object of subdivision of light.

Each of these steps is claimed to have been discovered or taken by Henry Goebel many years before Edison. Against all the improbabilities of this claim the story as related by Goebel in his several affidavits, with detail confirmations by many witnesses, is interesting, circumstantial and in many respects plausible, and I do not wonder that it has attracted such earnest advocacy by able counsel contesting this patent.

Henry Goebel is now 75 years of age, a German, came to this country in 1848, and has ever since resided in the city of New York. He appears to have been an excellent and ingenious mechanic, engaged in watchmaking, manufacturing barometers and thermometers and delicate instruments, and has shown much interest and aptitude in electrical appliances and experiments. He claims to have made incandescent electrical lamps, identical with the Edison claim in all particulars, from about 1854, and that these lamps were operated by primary batteries of his own construction and used at his store for show and lighting in various ways, and for some time had such lamps on a wagon traveling about the streets of New York with a telescope, also of his own construction. He says he made many of these lamps each year prior to Edison's patent, and all for his own use or gratification, but not so many after 1872 as before. In 1880 and later he was engaged in making electric lamps for the American Electric Light Company, a rival of Edison's and making similar lamps. This meagre statement cannot fairly present his story, but must suffice with mention that he was before leaving Germany very intimate with Prof. Moenighausen, who had experimented with the production of arc and incandescent electric lights, and gave him the ideas which he carried out here. Goebel does not claim that he ever worked or thought in the line of subdivision of electric lights, and the history of that art presents strong grounds for doubt.

As to the improbabilities of this discovery so long undiscovered, it is sufficient to refer to the comments in the opinions in telephone cases, 126 U. S., 556, in American Co. v. American Cushion Co., 35 Fed. Rep. 735, and American Co. v. People's Co., 22 Fed Rep. 309, as well applicable here. I will refer to some of the doubts raised, upon the defendants' showing, as to the actual components of these alleged Goebel lamps, remarking that the testimony of the numerous witnesses, however honest, speaking of such delicate structures seen by them many years ago cannot justly be accepted as absolute verity.

1. The fundamental thread-like carbon burner of Edison only became necessary as a means to subdivision of electric light, which was not contemplated by Goebel. The latter operated with a primary battery, for which the larger "pencil" form of carbon or other material would answer as well, would be more stable and more easily made. This filament is most delicate and difficult to make, and must have a high vacuum or it will be instantly consumed. It seems unnecessary and undesirable for his purpose, and no satisfactory reason is given for its adoption by him.

2. The Goebel lamps are not shown to have had the high vacuum required for anticipation. His principal statement must be taken that he exhausted his lamps by the Torricellian method in the years prior to 1879, and I think it is abundantly shown, although not without some contradiction, that such a method could not produce the vacuum necessary to prevent disintegration of the carbon; and it seems doubtful whether it could be employed at all with this delicate carbon in the receiver. If that vacuum was wanting, the claim fails.

3. No motive is shown for such constant manufacture of these lamps throughout the years from 1854 to 1880, involving so much of time and expense, and especially of great expense in maintaining the batteries for their use, and no attempt to dispose of even one, or to utilize them for domestic purposes excepting in a few stray instances. It seems improbable that the constant practice here asserted, and so useful for the purposes of this defense, would have been kept up without clear object.

4. Why did he not apply for a patent? He was not ignorant of the patent laws, for in 1865 he is shown to have applied for a patent on a sewing machine hemmer, and in 1881 he is found applying for some minor improvements, one of them being a coil shown in his exhibit lamps.

5. The lamps which Goebel produced at Boston, as original lamps, made in the early years, were four, called Exhibits 1, 2, 3 and 4. The first three only were produced at the hearing, with his original affidavit, the fourth being in the hands of counsel for defendant, but withheld because of doubts as to its authenticity—which doubts were afterwards cleared to their satisfaction, and this lamp then introduced by leave of court, with additional and explanatory proofs. The first three had copper and iron leading-in wires, were of what Goebel calls "meat saw" pattern, and show no vacuum now, and if fully proved would not constitute anticipation of Edison. No. 4, called the "hairpin" pattern, has the requisites, including a vacuum, although probably not the high vacuum. It is not now operative by reason of some defect. Goebel swears that it was operated, but experts who examined the defect swear that it has existed from its manufacture and it could not have operated. This lamp shows the highest excellence of the glass-blower's art, is stated by experts to be beyond the ability of any amateur; and many peculiarities are pointed out in the perfect shape of the carbon, the glass bridge and position of leading-in wires, which seem to show adoption of methods which have been produced and developed from the experience of commercial manufacture with Edison's invention. The statement as to its make, its keeping or its having been operated are not clear or convincing to the court, if they have been made so to counsel. Exhibit lamps Nos. 9 and 11, brought to St. Louis, are no more satisfactory than No. 4.

6. After Goebel's employment in lamp making by the American company, his claim of anticipation received some attention, and he had negotiations with one Dreyer in 1882 for arranging a company to exploit the claim. It failed, because he was then, apparently, unable to produce an original lamp. Later, it was investigated by eminent patent lawyers at various times, and apparently with great care and interest, to employ it in defenses against this patent, and also by one in behalf of complainant, and all rejected it as not well founded. Prof. Thomson, of the Thomson-Houston company, investigated it in 1882, when it would have been of vital interest to his company to make use of it against this patent, if tenable, and, after visiting Goebel, he rejected its consideration. Dr. O. A. Moses, an inventor with similar object, visited Goebel frequently, but came to the same conclusion, and says he was unable to produce any lamp. These are potent circumstances to raise doubt.

Coming to the new testimony produced for this hearing and which I have carefully considered, I find that the depositions of defendants are mostly cumulative, or in rebuttal of certain new affidavits produced by the complainant, and not here considered, but I cannot find that they remove any of the doubts above noted.

On the other hand, affidavits now produced by complainants tend to show an admission by defendants' witness Henry Goebel, Jr. (a son of the claimant), that he manufactured exhibit lamps Nos. 1, 2 and 3 in 1892, for the purpose of this case. There is no denial of this, but it is claimed that this son is venal, and has deserted the defense to favor the complainant.

One Heger, a glassblower, swears that he made for Goebel while working with him, "in the early eighties," lamps similar to No. 4, and he thinks he made this one at that time. As to a planer, which was produced by Goebel, as made by him at an early day to cut bamboo for his carbon burners, one Korwan and Heger swear that it was actually made by the former in 1885. This is contradicted as to date by an affidavit produced by defendants.

Upon the whole showing, I am satisfied that the complainants are legally entitled to preliminary injunction, and that it is the duty of the Court to grant it without evasion. As stated by Judge Colt, and often held, a bond by defendant is not the equivalent of the injunction which the law gives for the protection of the inventor in the exclusive privileges promised by his patent.

Injunction will therefore issue, but with leave to defendants to move for requirement of a bond by complainants to indemnify the defendants for any damages they may suffer if it shall be finally held that the patent is invalid.

An Analysis of Judge Seaman's Opinion.

A. P. Smith, Esq., one of the counsel for the defendants, made the following statement concerning Judge Seaman's decision :

" In regard to the Milwaukee decision, I may say that it will be promptly appealed, and that we have every expectation of securing a reversal upon such appeal.

" A careful study of the text of Judge Seaman's opinion has left this impression upon our minds—that the court regarded the attack made by the additional affidavits filed by the Edison company at Milwaukee to the effect that lamps 1, 2 and 3 were fraudulent, etc., as fully met by the rebuttal testimony taken under his order, and that he took up the case practically on the same showing as was made at St. Louis, and simply differs widely from Judge Hallett in the conclusions reached upon that showing.

" As to the matter of the decision, we were greatly surprised at its purport, possibly even more so than our opponents were. We had not supposed it possible that a defense which was presented with more completeness than half of those developed at final hearing would be swept aside on such an extreme view of the law and such a superficial knowledge of the facts.

"Do not understand me as presuming to criticise the action of the court in any improper manner. No one could be in Judge Seaman's courtroom continuously for a week, as we were, at the argument of the motion, and not come away with the highest respect for him as a man, and the fullest appreciation of his earnest desire to hold the scales with evenness as a judge. But it is clear that His Honor was led astray both on the law and the facts by the impassioned eloquence of the distinguished counsel of the Edison company.

" It was hardly possible in the time for the court to read and digest the several thousand printed pages of the record. In fact his statement after the hearing was to the effect that he should read only those parts to which his attention had been specifically directed. Under these circumstances, he was dependent principally upon the statement of counsel made on the argument as to what the facts were, and it is not, perhaps, strange that he should have altogether accepted the statements of our opponents in this regard, in view of the greatly superior lung power with which they were promulgated.

" Upon the question of law we understand this decision to hold that in opposition to a motion for preliminary injunction after adjudication sustaining the patent, the defendants' proof of a new prior use defense must be as strong as it would have to be to succeed at final hearing. The decision must be interpreted to mean thus: First, from the general tenor of its definitions of the requirements ; second, from the specific statement that the defense must be established 'beyond a reasonable doubt,' which is all that can be required of any defense on motion or final hearing.

" *Unreasonable* doubts would not be considered by any court, and if all *reasonable* doubts are to be overcome the defense must have been *absolutely* established.

" This view of the law we believe will be thrown out by any appellate tribunal of experienced judges, for the reasons, among others, that it does away with either final or preliminary hearings altogether, it being obviously unnecessary to merely upset at the second or final hearing what has been done at the preliminary hearing ; or to put it the other way, it is useless to have preliminary hearings if they are in reality final hearings ; also, for the reason that it is absurd to require a defendant to attain at a preliminary hearing, without the writ of subpœna, and in the limited time accorded by the practice, that measure of proof which can only be attained at final hearing, where years are frequently consumed. The writ of subpœna gives full power for compelling attendance of witnesses, and the scalpel of cross-examination lays bare equally their every innocent and willful misstatement.

"Our argument at Milwaukee was not specifically directed to the many matters which were fully argued before Judge Hallett, for the reason that we supposed under the rule of comity that the St. Louis decision would be accepted for what it covered, and that Judge Seaman would content himself with an inquiry as to whether the new evidence afforded ground for departing from Judge Hallett's ruling. This we supposed from the fact that the order of court under which our testimony was taken limited it strictly to matter in rebuttal of the new affidavits filed by the Edison people at Milwaukee. Judge Seaman, however, raked up all these old matters and based his decision upon them. Before an appeal late court, however, the whole case must be gone over again.

" I may say in conclusion that personally I welcome the privilege of an appeal to an appellate court which shall, once for all, decide the right to a preliminary injunction under this patent. It is virtually a return to our original plan of action, from which we were induced to swerve by the sweeping nature of Judge Hallett's decision in St. Louis. It was at first proposed to accept a *pro forma* injunction in the St. Louis case for the sake of at once getting it before the appellate court which should finally decide the question. It was subsequently determined to make a *bona fide* contest before Judge Hallett on the ground that by so doing we had two chances, to one the other way. Judge Hallett's decision showed the wisdom of that policy and established the validity and sufficiency, in our opinion, of the Goebel defense, an opinion which has been in no way shaken by the news from Milwaukee."

One of the counsel for the General Electric Company stated that the present decision is in line with that of Judge Colt as to law, and with both the Colt and Hallett decisions as to facts. As a consequeuce, in future applications for injunctions the plaintiffs can go into court with a record unanimously in their favor as to fact, and with two favorable decisions out of three on the point of law raised. The issue in future cases is therefore on a point of law unless the defense should introduce new testimony, as the previous records will be accepted as far as they are not affected by new testimony. The claim that a witness for the defense, Henry Goebel, Jr., was corrupted was pronounced absurd, the testimony in regard to his admissions of fraud having been based upon admissions made by him in the early stages of the preparation of the defense before any collusion could be charged, the truth of such admissions being supported by the proof and collateral facts. Raising this point had for its principal effect the discrediting of one of the principal witnesses for the defense by the defense itself.

It is stated that vigorous action will be taken at once against all the present infringers, and that the Columbia case will come up for final hearing in the fall unless it should be determined to apply for a reopening of the case upon the strength of the plaintiffs' present or future position in regard to the point of law involved in it or on the new evidence the plaintiffs have procured.

The Faure Storage Battery Decision.

In the United States Circuit Court for the Southern District of New York in the case of the Electric Accumulator Company vs the Julien Electric Company et al., Judge Coxe handed down a decision on July 18 in favor of the defendants. The first claim of the patent granted to Camille A. Faure, Jan. 3, 1882, as limited by a disclaimer to an electrode of a secondary battery to which the active layer is applied in the form of a paint, paste or cement, insoluble in the electrolytic liquid, was sustained by this court March 18, 1889. It was again sustained on rehearing. On the 19th of October, 1891, an order was made permitting the defendants to amend their answer by setting up the grant and expiration of a Spanish patent issued to Faure, June 27, 1881, for the term of ten years. Proofs were taken on this new issue, and the cause came on for rehearing upon this issue alone.

After examining into various features of the case, Judge Cox proceeds to consider whether or not what are called the principal inventions are to be found in both the Spanish and American patents, and briefly comparing the different claims of the two patents, he reaches the following conclusion :

I am constrained to think, therefore, that the invention of the United States patent, even though construed as the complainant insists it should be, is covered by the Spanish patent.

Few, if any, of the conditions are present here which differentiated the foreign from the domestic patent in Brush vs. this defendant [complainant], 47 Fed. Rep., 48, 58. On the other hand, many of the reasons are present which induced the Court to hold that " Case I " and " Case J" of Brush were for the same invention. (Brush vs. Julien Co., 41 Fed. Rep , 679, 683, 685).

It is thought that the principal invention of the United States patent is found in the Spanish patent ; that an electrode made pursuant to the latter patent would infringe the former, and vice versa, and that the former could not have been granted in this country if the latter had previously been granted here.

The subject matter is essentially the same in the two patents. An electrician, after reading one, would be as able to construct a mechanically coated Faure electrode as after reading the other.

It is argued that Section 4,887 is not applicable, for the reason that the United States patent was applied for before the Spanish patent was granted. This question is not an open one in this Court. (Gramme Co. vs. Arnoux, 17 Fed. Rep., 838 ; 21 Blatchf., 450. Edison vs. U. S. Co., 35 Fed. Rep., 134.)

Whenever the able and interesting argument in support of the complainant's contention is presented to a tribunal which is at liberty to consider it, it will unquestionably receive the attention it deserves.

It is argued for the complainant that the Spanish patent has a potential term of twenty years.

The patent was granted June 28, 1881, for a term of ten years. It expired June 27, 1891. On Aug 31, 1891, it was declared extinct by the proper authority. On March 20, 1883 two years after the patent was issued. Spain and France entered into a convention by which, in certain circumstances, the terms of patents might be extended. To this convention the United States was a party. The Director-General of the Spanish Department of Agriculture, Industry and Commerce, which has charge of all subjects relating to patents, decided that the provisions of this convention were retroactive. It is probable, therefore, that if application had been seasonably made, the patent would have been extended till June 27, 1901. But the application was not made until March 26, 1892, long after the patent had lapsed, and after the expiration of the time within which an application could be made for an extension. On the 20th of March, 1892, the application was denied.

It is thought that this subsequent international convention, even if it had the force of a statute, and it had not, cannot be considered as prolonging the term of the United States patent. It is not necessary to consider what might have been the result if the Spanish patent had been extended. It was granted for 10 years ; it expired in 10 years, and no effort was made to rehabilitate it until long after it had lapsed.

This is not the case of a patent granted for a long term, but expiring because of the failure to observe some condition subsequent. Here the life of the patent was definitely fixed for 10 years, and it never had any other term.

In Consolidated Roller Co. vs. Walker, 43 Fed. Rep., 575, 580, the foreign law providing for a potential term was in force when the foreign and domestic patents were granted, and it was held that the patents were limited by the optional, and not the designated, term. This is not such a case. (Bate vs. Gillett, 31 Fed. Rep., 809; Bate vs. Hammond, 129 U. S., 151; Opinion of Attorney-General Miller, April 5, 1889, 47 O. G., 398. Huber vs. Nelson, 63 O. G., 311.)

For the reasons stated in Brush vs. this defendant [complainant], 47 Fed Rep., 48, 55, this decision has been reached with reluctance. Those reasons do not, it is true, apply with the same force to an invention made abroad by a foreigner as to an invention made by one of our own citizens ; but the statute in its practical operation has failed to remedy the supposed evil at which it was aimed, and the duty of overthrowing a valuable patent under its provisions is one that the Court would naturally wish to avoid. But the question, Do the patents cover the same invention ? is fairly presented, and its decision cannot be avoided.

After giving the complainant the benefit of every reasonable doubt, the Court is convinced that the question must be answered in the affirmative. The longer the record is studied the more settled becomes the conviction that the invention which Faure patented in Spain and in the United States was the invention which he made and patented in France; that, so far as the inventor was concerned, the language was substantially identical, and that the changes in phraseology made by the translators and Patent Office officials, of which changes the inventor was ignorant, did not and could not operate to change the invention.

It follows that the defendants are entitled to a decree dissolving the injunction issued April 12, 1889.

In connection with this decision, the following communication has been received from Mr. Wm. Bracken, president of the Consolidated Electric Storage Company:

I send you herewith copy of decision rendered, on the 18th inst., by Judge Coxe in the United States Circuit Court for the Southern District of New York, in the case of the Electrical Accumulator Company vs. The Julien Electric Company, declaring the famous Faure patent to have lapsed and expired, by reason of the prior expiry of the Faure Spanish patent for the same invention.

This decision is the outcome of the long and protracted litigation between the parties now representing the Consolidated Electric Storage Company on the one hand, and the parties representing the Accumulator company, successors of the Electrical Accumulator Company, on the other hand. The contest has been maintained with unabated vigor for nearly seven years. At first the victory seemed to be on the side of the Electrical Accumulator Company, who obtained an injunction against the defendants on April 12, 1889, compelling the stoppage of the electric cars on Fourth avenue. Then the defendants got control of the Brush storage battery patents, and joining in the Brush suit vigorously attacked the complainants, defeating them: but the complainants maintained that it was but half a victory, for the reason that without the aid of the Faure process—" paste, paint and cement" the defendants could not make a practical storage battery, although possessed of the Brush storage battery patents—the fundamental patents; in other words, the complainants contended that the active matter or layer must, to be successful, be applied in the form of a paste and not in the form of a powder, as practiced by the defendants.

Late in 1890, the defendants became aware that the Faure Spanish patent would expire the following year. Steps were immediately taken to secure the proper documents from Madrid. The formalities to be observed in doing this were numerous and difficult to follow. However, after many disheartening setbacks and untold obstacles, the defendants succeeded in getting a complete record of the papers at Madrid, and had a rehearing in the case with the result that the patent was declared to have expired.

The situation now is, that although " paint, paste and cement,"as such, is no longer patented, yet it is not open to public use; for the reason that its application to the plate or support is covered by the fundamental Brush patents, of which this company is the exclusive licensee. As a matter of fact, the process is now owned by the Consolidated Electric Storage Company instead of by the Accumulator company, as fully as if the Faure patent were still alive and owned by the Consolidated Electric Storage Company, as if there had been a transfer from the Accumulator company to the Consolidated Electric Storage Company. Thus, by operation of law, the Faure process hitherto owned by the Accumulator company has become the property of the Consolidated Electric Storage Company.

Mr. W. H. Kenyon, of the counsel for the defense, stated that while the decision of Judge Coxe apparently left the Faure process open to all, yet the licensees under the Brush patent were the only ones who could take advantage of it, they alone having the right to apply active material to a supporting plate in any form. He also stated that there was no other fundamental question at issue with the Accumulator company, a case now in court being upon a matter of detail based upon the reissue of the Swan perforated plate patent; as the Consolidated Electric Storage Company can now use, and are now using a perforated plate with the perforations filled with active material and a surface coating of active material besides, the matter at issue has no great weight. Word comes from Trenton this morning that the motion for preliminary injunction on the Faure patent against the Electric Launch and Navigation Company (which owns and is operating the electric launches at the World's Fair), and against the General Electric Launch Company had been denied. This motion was argued on June 29, and as the denial is unaccompanied by any written opinion it is doubtless based upon Judge Coxe's decision in New York.

One of the officers of the Consolidated Electric Storage Company made the following statement in regard to previous litigation with the Electrical Accumulator Company:

The first storage battery suit in the long line of litigation between the Electrical Accumulator Company and the Julien Electric Company and its successors was brought in 1886 by the Electrical Accumulator Company against the Julien Electric Company on the Faure patent No. 252,002, being the patent declared expired in this decision. In that suit Judge Coxe sustained the Faure patent No. 252,002, but limited it by a disclaimer, in which Faure was awarded merely the application of the active matter to a conducting support in the form

of a "paint, paste or cement." At this time Mr. Brush's patents had not been passed upon by the courts, though Judge Cox in that decision intimated that while Faure was *de facto* the first inventor, yet Brush was *de jure* the first inventor. Then came on the Brush suit against the Electrical Accumulator Company, which culminated in Brush being awarded the broad claim of the *mechanical application* of the active matter to the support plate *in any form*; that is, no matter what the form of the oxide might be, whether paste or powder, only Brush or his licensees have the right to *apply* it to the support. In other words, Brush was awarded the invention of applying active material *mechanically*, as distinguished from Planté's mothod of producing the active matter by disintegration. This left the Faure patent in the position of being an invention for making the oxide into a paste, but without the right to apply it to the support unless licensed by the Brush company. The licensees of the Brush company, the Consolidated Electric Storage Company, therefore applied the active matter in the form of a powder; but the Accumulator company contended that a successful battery could not be made by applying it except as a paste. The expiry of the Faure patent, therefore, allows the Consolidated Electric Storage Company or licensees of the Brush company to apply the active matter in the form of a paste, if they so desire. The fact that *only* the Consolidated company can use the "paint, paste and cement" makes the Faure process virtually their property. The Faure patent was the chief support of the Accumulator company. Its factory has, however, been closed for a year past by reason of an injunction in favor of the Consolidated Electric Storage Company on the Brush patents.

One of the counsel for the Electrical Accumulator Company, in reply to inquiries, stated that the decision of Judge Coxe would not be accepted as definitive, but that an appeal would be taken; that the real effect of the decision is not, as claimed, to transfer the Faure process from the plaintiffs to the defendants; and that the entire matter at issue between the two companies was not involved in the suit in question. More definite information from the plaintiff's counsel could not be obtained.

Arc Lamps on Railway Circuits.

The following communication has been received from Mr. Lansing Morse, of A. Wirsching & Sons, New York City:

You state in your description of the Siemens & Halske exhibit at the World's Fair that you have "yet to hear of any attempt in this country to place eight constant potential arc lamps in series on a 500-volt circuit."

I installed 10 arc lamps on the circuit of the Allentown & Bethlehem Railroad Company at their park, midway between Allentown and Bethlehem, which was afterward changed to eight, and they have been burning over a year In April of this year I installed 11 arc lamps on the circuit of the Union Railway, West Farms, Westchester county 550 volts at station) and they have been burning continuously ever since.

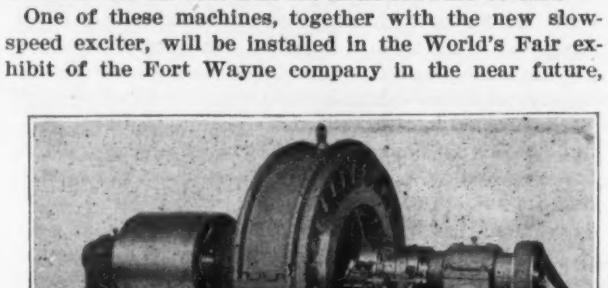
A New Alternator.

We illustrate the new "Wood" 3,000-light machine, which is a slow-speed ironclad alternator lately brought out by Mr. James J. Wood, electrician and general superintendent of the Fort Wayne Electric Company. This machine embodies several novel features, and a glance at the cut shows that the machine is symmetrical in appearance. The bearings are large and ample, and the various pieces composing the machine are made as small and as light as possible, making it easy to handle in stations where there are no special arrangements for the handling of heavy machinery. The shunts, which are usually found in most compound alternating wound machines, are here placed in the main pillow block, where they are out of the way of the dust or injury from any source. The brushes are placed on a separate pedestal, having a very accurate adjustment, which is effected by a small hand wheel, which may be seen in the cut. The brushes are in independent pairs, making it possible to take one brush out from one side for cleaning or other purposes while the machine is in operation. The spiders on these large-sized machines are of iron, and the armatures are built up of small laminated C-shaped stampings, rendering the same light, giving ventilation and reducing the cost of construction to a minimum. The amount of wire used is very small, and the number of volts per foot is greater, it is claimed, than in any other machine built. The machine is arranged for driving in any position, and the main frame is cut away so as to admit of the belt passing through the floor.

The bearings are large and self-oiling, self-aligning, and of the expansion type, that is, they are hung in iron pillows which are separated from the main pillow block. This allows of absolute ventilation, and permits of a large amount of oil being put on in a seemingly very small space. The exciter wires are connected on the lower side of the machine to small insulated terminal blocks; in fact, the whole arrangement of the machine leaves nothing to be desired.

The draft from the rotating armature is utilized to ventilate both the crown of the machine and also the pillow blocks, etc. The air is forced into the crown and out the bottom end, and there finds channels which connect with the side pillow blocks. The air is thus circulated through the entire machine, and is, in this way, utilized to advantage. The armature runs perfectly cold under extreme loads. Of course the value of this forced draft would be considerably impaired if it were not for the fact that the armature runs so cold.

One of these machines, together with the new slow-speed exciter, will be installed in the World's Fair exhibit of the Fort Wayne company in the near future,

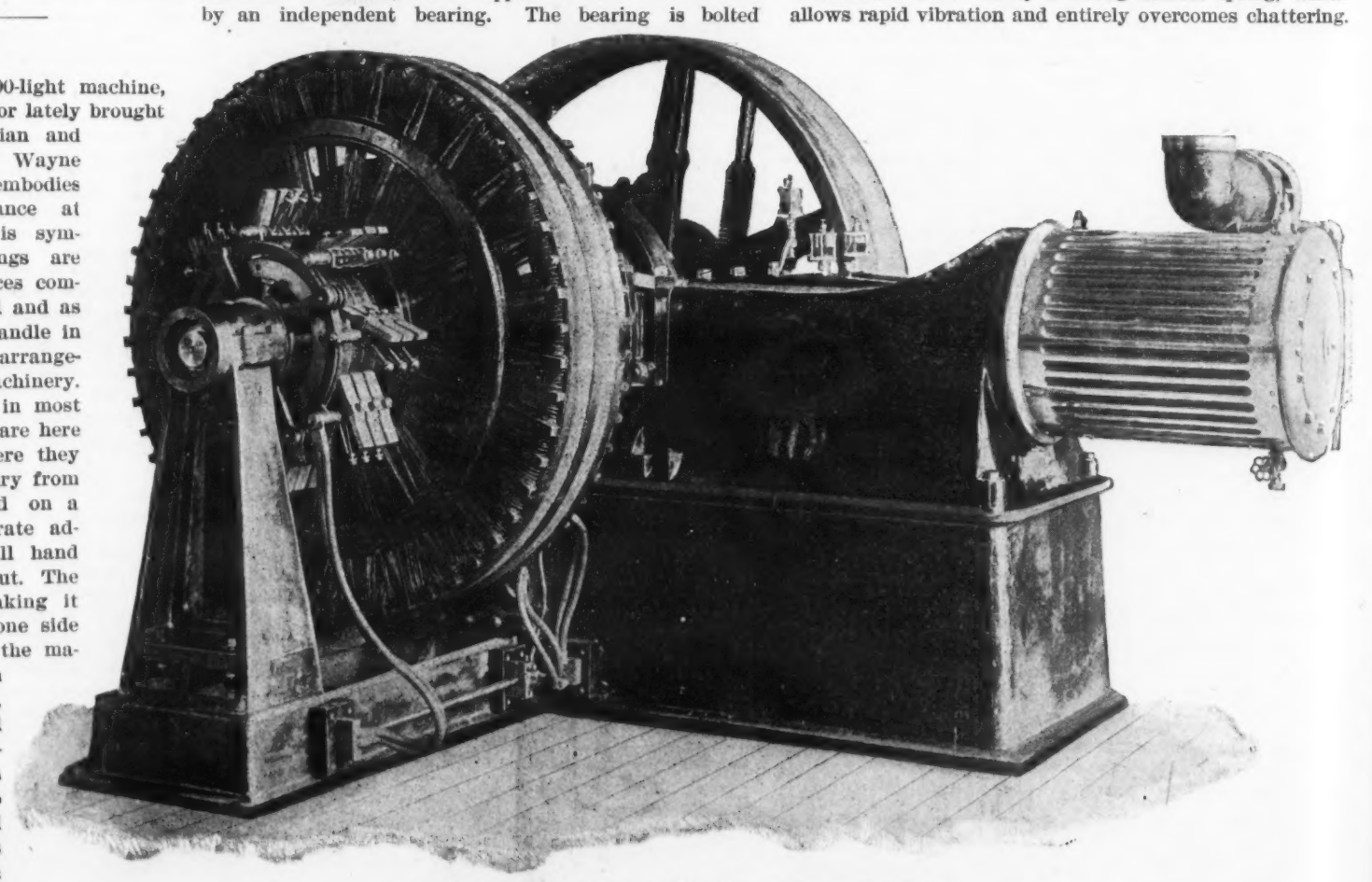


THE NEW WOOD ALTERNATOR.

where those interested in the advancement of electric lighting by alternating machines will have an opportunity to inspect them.

Direct Connected Engine and Dynamo.

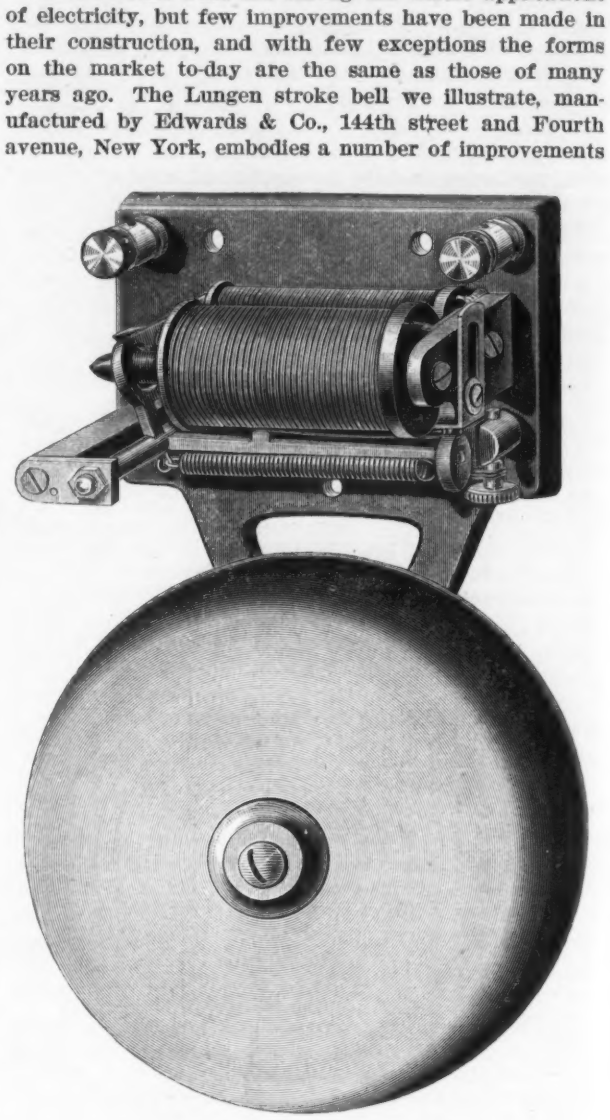
The advantage of dispensing with pulleys and belts, and making the engine and dynamo one machine, has recently led to considerable development in this direction, and among those who have taken a prominent place in this movement has been the Ball & Wood Company, of New York and Chicago, the well-known engine builders. The high armature speed of the dynamo has long been one of its drawbacks, but in the multipolar type of dynamo the electrical engineer has made as notable an advance as that seen in the evolution of the high-speed engine. By presenting a greater number of poles to the armature, the same rate of change in cutting the lines of force is secured with a much lower number of armature revolutions. The dynamo builder has thus wisely come down in rate of speed, while the engine builder has come up, and they have met on ground where they can be extremely useful to each other, and the new combination bids fair to be popular. The accompanying illustration shows a Ball & Wood engine of 100 h. p., carrying on an extended shaft an armature, and supported at its outer end by an independent bearing. The bearing is bolted to a base plate, common to the engine also, and if desired, can be adjustable. Changes are made in the patterns of the engine frame to provide for carrying the fields, and thus a compact and complete whole is formed. The dynamo was built by the Waddell-Entz Company, of Bridgeport, Conn. In actual work it is found that there is no loss in efficiency in either dynamo or engine, and that in regulation the same excellent results are obtained which give this engine such prominence.



DIRECT-CONNECTED ENGINE AND DYNAMO.

A New Electric Bell.

While electric bells are among the oldest applications of electricity, but few improvements have been made in their construction, and with few exceptions the forms on the market to-day are the same as those of many years ago. The Lungen stroke bell we illustrate, manufactured by Edwards & Co., 144th street and Fourth avenue, New York, embodies a number of improvements



THE LUNGEN ELECTRIC BELL.

and is particularly applicable for railroad signals, depots, factories, fire alarm purposes and similar uses where reliability is a desideratum.

The bell is arranged to strike with a regular motion like the pendulum of a clock, and the hammer rod, though short, has a long sweep, and gives a powerful blow with a clear and distinct sound. The hammer ball is attached to its rod by a strong flexible spring, which allows rapid vibration and entirely overcomes chattering. By using two circuit closers the bell can be operated both ways. The magnets are wound to ten ohms with silk-covered wire, and there is a non-sparking attachment to prevent the platinum contact points from burning. Both the tension and length of stroke are adjustable. The magnet is constructed so that the instant the circuit is closed the armature is attracted with a constantly increasing force until it reaches the surface of the magnet poles.

NEW BOOKS.

THE ELECTRIC TRANSMISSION OF INTELLIGENCE, AND OTHER ADVANCED PRIMERS OF ELECTRICITY. By Edwin J. Houston, A. M. New York: The W. J. Johnston Company, Limited. London: Whittaker & Co. 1893. 330 pages; 88 illustrations. Price, $1.

The first volume of Professor Houston's Advanced Primers is devoted to the general principles of electricity and to voltaic and atmospheric electricity; the second volume deals with electrical measurements, dynamos, motors, transformers and their applications to lighting and power, alternating currents and their phenomena and some minor subjects. The third and concluding volume, which has just issued from the press, takes up telegraphy and telephony, storage batteries, electrolysis and electro-metallurgy and the remaining applications of electricity that have practical importance.

While the three volumes thus cover the entire range of electrical science, there is no necessary connection between them, nor even between the various primers of each volume, and those interested in the subject of which the present one treats will not, therefore, need to be acquainted with the preceding volumes to read understandingly.

Of the features that have made this series so popular, a striking one is the clear and logical method of the author in the treatment of the various subjects, and, notwithstanding the simple and popular style, with no lack of scientific accuracy. The bane of popular books is usually a lack of perspective, only the most simple and curious points being given to the exclusion or subordination of more important ones, but that defect has been entirely avoided in the present series, yet without any sacrifice of real interest.

Another feature is the abstracts from standard authors at the end of each primer which enlarge upon important points in the primers, and at the same time give the reader an introduction to electrical literature.

In the concluding volume Professor Houston's lucidity of exposition will be especially appreciated in the primers on multiple time and cable telegraphy. These subjects, and particularly the former, have heretofore been mysteries to even the student of electricity, but are now placed within the grasp of every one. The same may be said of telephony, electro metallurgy and the storage battery, all of which have entered so largely in modern life that he who wishes to be considered intelligent should know at least the main outlines of these subjects.

While the purposes of the primers is primarily for the instruction of the general public and first-year students of electricity, yet from the comprehensive range of subjects almost every electrican will find them useful to some extent, and particularly as a review and as reference books, even in his own line of work.

POLYPHASED ALTERNATING CURRENTS. By E. Hospitalier. London: H. Alabaster, Gatehouse & Co. New York: D. Van Nostrand Company. 84 pages; 31 illustrations. Price, $1.40.

With the development of electric transmission of power multiphase alternating currents and apparatus are becoming of more and more importance, and he who neglects this branch of electrical engineering will soon find himself relegated to the rear. The subject is by no means a simple one to master, partly on account of the introduction of ideas little familiar to those who have heretore devoted their attention to continuous currents, and partly on account of inherent difficulties. It is therefore fortunate for the student that M. Hospitalier has placed at his disposal one of those admirable expositions for which he is noted, in which the French clearness of expression and faculty of logical statement are happily joined to a keen appreciation of the practical bearings of a subject that alone would give his works an unusual value.

Triphased currents are first taken up and explained and then, in turn, triphased generators, transformers and motors. Methods of winding both generators and motors are given, and the machines and converters employed in the Lauffen-Frankfort transmission are used for illustration. The various questions relating to revolving fields, high tension lines, efficiencies and lighting circuits are treated at greater or less length, and different transformers, generators and motors explained in detail. A section is next similarly devoted to diphased currents and apparatus, and a practical comparison made as to the relative value of diphase and triphase systems. In appendices are given practical data and information relating to the Lauffen-Frankfort and Heilbronn-Lauffen transmissions.

PRACTICAL DYNAMO BUILDING, WITH DETAIL DRAWINGS AND INSTRUCTIONS FOR WINDING, GIVING CORRECT SIZES OF WIRE, DIMENSIONS OF IRON, ETC., ETC.: ALSO DIAGRAMS FOR HOUSE WIRING. By L. C. Atwood. St. Louis. 1893. 143 pages, illustrated. Price, $3.

This work is designed especially for amateur builders and non-professional men, and all measurements and instructions for winding are taken from machines in actual service, particular attention being paid to every detail of construction.

Minute instructions are given for the winding of Siemens and Gramme armatures, and working drawings and directions are laid down for constructing four, ten, fifteen, thirty-five, sixty and one hundred and fifty-light incandescent dynamos, and a one-light arc dynamo. As the drawings are figured and the instructions are full, precise and practical, the amateur or mechanic should find no difficulty in constructing any of the dynamos described.

A number of wiring tables are given, as well as the New England Insurance Exchange and New York Board of Underwriters' Rules (1893.) Chapters on various subjects relating to the practical working of the dynamo are included; others on how the electric current is produced, the history of electricity and the electric light, the incandescent system and storage batteries, are reprinted from another publication, and one on the economy of the electric light is from THE ELECTRICAL WORLD.

LITERARY NOTES.

We are indebted to Mr. David R. Walker, chief of the Philadelphia Electrical Bureau, for a copy of his annual report to the Mayor. Among other interesting information is an account of a visit of inspection to several storage battery and underground conduit roads, and descriptions of underground wire conduits.

In a recent report (for which we are indebted to Mr. Eckley B. Coxe) of the Pennsylvania Commission appointed to investigate the waste in coal mining with the view to the utilization of the same, is given an account of the experiments made in burning small anthracites and considerable information of importance to users of refuse coal. (Harrisburg, Pa.)

The "Bulletin de L'Association des Ingénieurs Electriciens Sortis de l'Institut Electro-Technique Montefiore," Liège, Belgium, in its last issue contains papers on the employment of gas engines for isolated electrical installations (M. Bourquin), a study for an electrical railway with overhead line and ground return (M. Dawson), and a paper by MM. Feldman and Nagtglas-Versteeg on the relation between the candle power, the voltage and the energy of several modern incandescent lamps. The experiments on the candle power of incandescent lamps showed that the results calculated from the formula c. p. $= K W^3$, where W = watts, coincided well with those obtained by actual measurements. The formula c. p. $= K V^{6.8}$, where V = volts, was not so satisfactory, and further tests would doubtless have shown the experimenters that no formula based on current or voltage would be satisfactory, while the contrary is the case when based upon the energy used, as demonstrated again by the present experiments. (Gauthier-Villars et Fils, Paris.)

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, July 22, 1893.

Electrical stocks have again occupied much of Wall street's attention this week. In fact, during the past few days, transactions on the Stock Exchange have at times been altogether given up to dealings in General Electric or in Western Union. The course of quotations of these stocks have been sensational. In some respects the rise and fall in their values has but reflected conditions exerting an influence upon the whole railway and industrial list. But the changes in their quotations have been so violent as to clearly evidence the presence of specific causes to affect their stock market worth. They have furnished examples of what is able to be done in a market that has been turned over exclusively to professionals where causes favorable and unfavorable are discounted with a rapidity and a violence that reveal better than any diagnosis of the causes the unhealthy and abnormal conditions with which the stock market is now surrounded. There is no gainsaying the fact, as has been demonstrated particularly by the slump on Thursday in General Electric's quotations, that the stock market is particularly liable to sudden and extreme breaks, while at the same time it is a matter of exceedingly hard work to rally prices. Under such circumstances the prediction that electrical and other stocks are bound to go lower cannot be contradicted with any assurance. On the other hand it must be admitted that in the unstable condition of Stock Exchange sentiment, circumstances may arise that may give the whole list a tremendous boost. In such an event the electrical stocks which, like other industrials, have suffered particularly from the effective attacks made upon their quotations, must respond more readily than the general Exchange list to the booming influence of favorable factors.

General Electric sold at 46 on Friday. Six months ago its price was 114. The tremendous depression that has resulted in this break in prices has been accompanied from time to time by any number of reports reflecting upon the financial condition of the company. These have all along been persistently denied by the officials of the company, but the continued decline in prices shows that the stock has been sold by other than bear traders. The first attacks upon the company were made on the ground that it was to reduce its dividend and that it might even pass the distribution of profits to stockholders. When the falsity of this was proved by the declaration at the proper time of the regular quarterly two per cent. dividend, the bears resorted to other tactics to influence the price of the stock. Any number of derogatory statements were scattered broadcast. The climax came on Thursday last. On that day the stock ran up in the early dealings to 55¾. At this point selling of the stock on an enormous scale developed, which suggested nothing else but liquidation, and on transactions of 50,000 shares the stock went to 46½, closing at 48¾, a decline for the one day of 6 points. Friday morning the stock again went to 46, but it rallied from these points. These tremendous losses were effected by the free circulation of a report that the company was going into a receivership. The daily papers on Thursday morning had announced the application in the courts for a receiver for a company, the name of which the lawyers interested refused to divulge. The street jumped to the conclusion—there is no telling how the report was started—that the General Electric Company was the concern involved in this mysterious litigation. In the excitable state of the market, and in Wall street's susceptibility to unfavorable news, the stock's quotations fell off with a rush that was sensational. The officials of the company hastened to deny the report, but its circulation had attained such proportions that even the official contradiction of the story and the making public of the name of a small business corporation which was really involved in the receivership proceedings above alluded to did not serve to stem the downward course of the stock. Just why Wall street should have been so ready to believe that the General Electric Company was ready for a receivership is hard to understand. The officials of the company have been steadfast in their declarations that its business is good, and that its financial condition is sound. President Coffin states that just now the company had cash on deposit in New York and Boston banks to the amount of $1,700,000. It is explained that the ease with which the bears affected its value is brought about by the fact that the stock has never been well distributed. When first placed upon the market the principal buyers were big capitalists and business men, who took the shares in large blocks. In the present financial stress these large holders have either through fright or necessity been compelled to throw over their possessions, and the bears, taking advantage of this forced liquidation, have done everything to help along the decline brought about by the sale of long stock. How successful they were the course of the stock as outlined above will show. One good result of the week's slump will be that the stock has now been scattered around in such small lots that it will never again be subjected to the pressure caused by the throwing overboard at one and the same time of several large blocks. For an eight per cent. dividend stock, 46 is an exceedingly low price. Small investors were not slow to take the opportunity of picking up a bargain, and the large amounts of small lots traded in in the rally from the low price shows how eagerly investors—what Wall Street now calls "panic birds"—are waiting to make cheap purchases. There is every reason, say the officials of the company, why the stock should be worth more to-day than it has been for a long time. For instance, during the past week orders were received aggregating $250,000. Most of this was for small supplies, on which the profit is larger than upon big orders. Then again, the United States court has just announced a verdict which is said to be one of the most important victories the General Electric Company has ever gained. The officers of the company in speaking of it made this official announcement on Thursday: "An important decision was filed to-day in Milwaukee by Judge Seaman, of the United States Circuit Court for the District of Wisconsin, in the suit brought by the Edison General Electric Company against the Electric Manufacturing Company of Oconto, Wis., upon the now well known Edison incandescent lamp patent. The suit in which the decision was rendered was brought against the Oconto company for infringement of the Edison patent by manufacturing and selling incandescent electric lamps, and the decision filed to-day grants an injunction against the Oconto company, restraining it from any further manufacture or sale of such lamps. The decision of Judge Seaman is in line with the decisions of Judges Wallace, Shipman and Lacombe, of the Second Circuit, and of Judge Colt, of the Massachusetts Circuit, and acquires especial significance and importance in view of the fact that the validity of the Edison patent was attacked by the defendant through what has become known as the alleged "Goebel anticipation." The issue of the injunction is a finding by the Court against the Goebel defense. The argument of the motion consumed an entire week in Milwaukee, and the vast interests at stake have caused the decision to be awaited with unusual interest." Apropos of the dividend of 2 per cent., that is payable Aug. 1, the officials of the company announce that the money for it has been on deposit as a special fund since early in the month. This disposes of the specific rumors dealing with the ability of the company to meet the dividend obligation. The liquidation in the stock, to which reference is made above, is traced in a good many instances to Boston people who received General Electric stock in return for their Thomson-Houston holdings. There are hints of dissensions between the New York and Boston factions in the company. All this space is given to General Electric matters for the reason that it has furnished this week the feature of stock exchange transactions. What the coming course of its quotations will be is hard to predict. There is any amount of adverse talk and the failure of insiders to render any support to the stock is unfavorably commented upon. On the other hand, such news as is substantiated by fact is extremely favorable to the General Electric Company and must be construed as bull points.

Western Union Telegraph stock shared at one time in the beginning of the week Wall street's particular attention. But the effect of it was just as disastrous to its quotations as was the deal of time given up to General Electric. Western Union went down this week to 74⅞, which is a point lower than it ever got in 1891, and seven points below the lowest in 1892. This week's quotation is also the lowest recorded since Jan. 1 of this year. The bear talk on this property continues, and the bears have been more aggressive than ever in their attacks upon its Stock Exchange value. A great deal of capital has been made out of the point made in these columns last week, that the revenue of the company is being steadily cut down by the increased competition it is meeting with through the largely increased use of private telephone lines. For instance, the Pennsylvania Railroad Company has equipped all its lines with a long distance telephone system, and it has completely abandoned the use of the telegraph for communication between the various heads of departments and divisions located in the different cities along its entire length. Several others of the big railway systems of the land are preparing to make similar changes in their method of communication between officials. The claim is made that the telephone is quicker. It is more reliable. Again, managing officials can speak to each other without divulging secrets of administration to outsiders. Communication is made easier. Now that certain telephone patents have expired, it will not be long before the cost of speaking from one end of the country to the other will be materially cheapened by the competition that the introduction of new telephones must bring about. A great deal of business is at present done between many of the large cities over private telegraph wires, for the use of which large royalties are paid the Western Union Telegraph Company. These private wires are being daily discarded in large numbers in favor of private telephone systems. The officials of the Western Union Telegraph Company themselves admit that there has been a falling off in gross earnings for the past quarter. Wall street has been inclined to listen favorably to these adverse arguments and they have been used with telling effect. As in General Electric, liquidation from important sources has occurred just at a time to help along bear endeavors. The decline in the beginning of the week was accompanied by a report, and there seemed to be very good foundation for the statement, that the Baltimore & Ohio Railroad Company is marketing the 50,000 shares of Western Union Telegraph Company stock which it received some years ago in payment for the Baltimore & Ohio Telegraph Company plant. The railroad company is said to need the cash and is disposing of its treasury stock of Western Union to get the needed money. No official contradiction has been made of this report.

The Westinghouse Electric and Manufacturing Company has, like other electrical companies, made a move in the direction of retrenchment. At its Newark plant 500 men have been temporarily laid off, and it is reported that the Newark factory may be eventually moved altogether to Pittsburgh. The electrical companies are everywhere putting themselves in a sound position by similar processes of economy. Following a similar policy the General Electric Company closed its foundry shops in Massachusetts. The condition of the electrical companies throughout the country, according to the views of a manufacturer, cannot be said to be good. It is a well known fact, says he, that many of the electrical companies are doing business on a basis that banks will not loan money even on their bonds. Inflation has in past months been the chief characteristic of their methods of doing business. In the present financial stress business men in all branches of trade have found it next to an impossibility to obtain proper accommodation.

The electrical companies have not been an exception in this inability to obtain funds, and the present policy of retrenching has been adopted as a means of getting on a cash basis. In present money conditions this is the only method in which they can continue in business. It curtails receipts by cutting down product, but it insures solvency.

The Edison Electric Illuminating Company of Boston will increase its capital stock by $500,000, making the total capital stock $3,500,000. This increased issue of stock is to be put out in order to obtain funds to place its wires underground, and to extend its system, thereby assuring increased efficiency. As stated last week, the company will pay on Aug. 1 a dividend of 2 per cent.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	25	30
Detroit Electrical Works	10	2	3
East River Electric Light	100	..	65
Electric Con. & Supply Co. pref.	15	15	16
" " " " " com	15	15	17½
Edison Electric Ill., New York	100	98	99
" " " lsts	...	101	102
Edison Electric Ill., Brooklyn	100	93	98
" " " Boston	100	115	130
" " " Chicago	100	220	230
" " " Philadelphia	100	120	140
Edison Electric Light of Europe	..	2	6
" Bonds	..	80	85
" Ore Milling	..	5	12
Fort Wayne Electric	..	12½	12¾
General Electric Company	100	49	49½
" " deb. 5's	..	70	71
Interior Conduit and Ins. Co	100	30	40
Mount Morris Electric	..	..	65
Westinghouse Consolidated	50	18	22
" " pfd	50	37½	42½
Western Union Tel	100	75⅝	75¾

NEW INCORPORATIONS.

The Crystal Lake Street Railway Company, of Scranton, Pa., with a capital stock of $50,000, has been formed. P. S. Page, T. H. Watkins and J. Alton Davis, all of Scranton, are interested.

The Centralia Light and Power Company, Centralia, Ill., capital stock $31,000, has been formed to manufacture and sell electricity. Seymour Andrews, F. Kohl and G. L. Pittinger, are the promoters.

The Milwaukee Electric Street Railway Company, Milwaukee, Wis., capital stock $300,000, has been formed to operate a street railway in that city. The incorporators are C. F. Pfister, C. Landsee and C. Quarles.

The Technic Electrical Works, Camden, N. J., capital stock $20,000, has been incorporated to do a general manufacturing and supply and repair business. D. Pepper, Jr.; A. L. Register, Philadelphia, Pa., and J. J. Zimmele, Camden, N. J., are interested.

The Allegheny & Kiskiminlas Electric Railway Company, Philadelphia, Pa., capital stock $700,000, has been formed to construct and operate an electric railway. F. A. Phillips, S. H. Hicks and E. Lukens, of Philadelphia, are the promoters.

The Elwell Parker Electric Company of America, Cleveland, O., maximum capital stock $500,000, has been formed to manufacture and sell dynamos, motors, apparatus, etc. E. H. Phillips, F. C. Phillips and A. E. Brown, all of Cleveland, O., are the parties interested.

The Hubbell Improved Battery Company, Portland, Me., capital stock $250,000, has been formed to manufacture and deal in electrical batteries and machinery of all kinds. C. J. Hubbell, G. H. Gardner, S. A. Fuller and J. A. Riedel, Boston, Mass., are the parties interested.

The Enosburg Falls Electric Light and Power Company, Enosburg, Vt., capital stock $10,000, has been formed to furnish electricity for light, heat and power purposes. The promoters are H. F. Holland, C. F. Eldridge, Boston, Mass.; H. D. and I. H. Kendall and John Fish, Enosburg.

The Santa Monica Electric and Power Company, Santa Monica, Cal., capital stock $40,000, has been incorporated to generate and deal in electricity. H. V. Carter, Los Angeles; A. Steadman, Morovia; F. Carter, J. J. Davis and H. A. Winslow, of Santa Monica, Cal., are the parties interested.

The Dubuque Light and Traction Company, Dubuque, Ia., capital stock $630,000, has been formed to construct, maintain and operate electric light and street railway plants. J. S. Cummins, W. J. Ballard, E. A. Duncan, G. K. Wheeler and J. L. Martin, Dubuque, Ia., are the promoters.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-176 TIMES BUILDING, NEW YORK, July 24, 1893.

Mr. C. O. Mailloux, 25 William street, New York, is designing a municipal plant for North Attleboro, Mass., and has been appointed consulting electrical engineer by the council of Rome, N. Y., which proposes to put in a town lighting plant. Mr. Mailloux has also been retained to design the large light and power plant for the immense Vanderbilt estate in North Carolina.

Electro-therapeutic Course.—The importance of electricity in medicine is now coming to be generally recognized and many medical men of acknowledged standing have undertaken a course of special study in this line. Many practitioners, however, who are unable to avail themselves of a regular post-graduate college course will welcome such an opportunity as is offered by the private clinic of Dr. Robert Newman, of New York, who has consented to give private lectures on electro-therapeutics, and particularly on surgical electrolysis. The course will consist of 12 lectures in which clinical instruction is predominant, and will begin on Nov. 1, the class having already been made up. Dr. Newman is well known in this field, and he has also been invited to deliver clinical lectures on electrolysis in Chicago, before the Post-Graduate Medical School, during the course which begins Sept. 1.

ALBANY, July 22, 1893.

The Hudson River Telephone Company is putting up a new metallic circuit line between Canajoharie and Fort Plain.

Mr. C. R Pearl, chief operator of the Hudson River Telephone Company, has returned home after a two-weeks visit to the World's Fair.

The Stillwater & Mechanicville Railway Company reports for the quarter ended June 30: Gross earnings, $2,102.55; net income, $33.94; for the corresponding quarter last year the net increase was $58.27. The balance sheet shows a profit and loss surplus of $196.64.

The night force at the works of the General Electrical Company at Schenectady, numbering about 300, have been laid off for an indefinite period. There has also been a slight reduction in the day force. The condition of the industrial market is said to be the cause of the reduction.

The Union Telegraph and Telephone Company, of Saratoga, have sold out to the Hudson River Telephone Company, for $100,000. The Hudson River company held 51 shares of the Union company's stock, and the remaining 49 shares will be paid for in stock at par value.

PITTSBURGH NOTES.

PITTSBURGH, July 22, 1893.

The Nunnery Hill Incline Company, of Allegheny, has been experimenting with an electric system, which is to be used for the operation of the cars on the incline. The company believes that by this method the incline can be run more economically and much easier. It is said that this is the first incline in the country operated by electricity.

The Allegheny & Kiskiminetas Electric Railway Company has been granted a charter to build a road 15 miles long from Etna borough to Sharpsburg and connecting Aspinwall borough and Hites township. The capital of the company is $700,000. The president is T. H. Hicks, of Philadelphia, and the directors are Ezra Lukens, A. P. White and F. A. Phillips, all of Philadelphia, and J. R. Davis, of New York City.

The Westinghouse Electric and Manufacturing Company's plans for the new factory, which it contemplates erecting at Brinton, near this city, are now nearly completed, and it is expected that ground will be broken by Sept. 1. The plant will consist of three main brick buildings and several smaller ones. The machine shop will be 750 feet in length by 312 feet wide, and it will have three floors. The foundry and casting shop will be 725 by 300 feet with two floors. The third building will be of the same dimensions as the foundry and will be used as a storage and ware house with rooms for packing and finishing. In building this works the Westinghouse company intends to concentrate its electric manufacturing business in one plant. The company has now factories in Allegheny, Pittsburgh, Newark and New York. The works will be supplied with the most modern of labor saving appliances, and the capacity for turning out work will be enormous. The plant is expected to be in full operation by next July.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
936 MONADNOCK BUILDING, CHICAGO, July 22, 1893.

The Underwriters' International Electric Association expects to have a meeting of its electrical committee at Chicago, Aug. 17.

George Cutter, "The Rookery," Chicago, has issued a little pamphlet containing a well written description of that model office building, "The Rookery," which is none the less known for being the headquarters of one of the best known and most original members of the electrical fraternity, George Cutter.

CLEVELAND, O., July 22, 1893.

The Cleveland Telephone Company offered the city free use of wires for telephone and telegraph and fire alarm purposes in the underground cables which they now have and which are being put in place, provided the clause which binds the telephone company to allow telephone companies to rent their wires be stricken out of the permit under which they are placing their cables.

Special meetings of the Board of Control have been held with reference to relieving the press of traffic on Superior street, the four tracks on which are already overcrowded, and each month the situation is becoming worse. A statement being made by Vice-President Horace E. Andrews, of the Cleveland Electric Railway Company, that the traffic is doubling every three years, and that other outlets are now advisable, and in the near future will be imperative, the City Board of Control desire that immediate steps be taken in order that any street about to be repaired be not torn up after the paving has been placed.

OREGON CITY, Ore., July 17, 1893.

Mr. H. M. Byllesby, president of the Northwest General Electric Company, of St. Paul, was recently in the city on a tour of inspection.

The Woodstock Railway line, in Portland, Ore., has inaugurated an electric freight service to accommodate the suburban districts traversed by that system.

The Tacoma (Wash.) Board of Public Works has closed a contract with F. W. Hicks & Co., of Tacoma, for the electric and gas fixtures for the first floor of the new city hall.

A Spokane (Wash.) street car, in charge of Conductor Bishop, was held up by a gang of robbers on its last trip the night of July 4. A desperate fight took place in which the motor man and conductor came off victorious. One of the toughs was shot and they broke all the car windows and made their escape.

Everett, Wash., now has an electric railway in successful operation. Regular service was inaugurated July 4 with some ceremony. The plant and equipment are first class in every particular. The company was fortunate enough to secure, as construction engineer, Leo Daft, the pioneer electric railway inventor.

The Willamette Falls Company has just been incorporated, with a capitalization of $100,000, by P. F. Morey, Chas. H. Caufield and H. Z. Burkhart. Its principal office is in Portland, Ore. Among the purposes of the company are: To operate and maintain canals, locks, basins, water rights and privileges and water powers at or near the Willamette Falls, at Oregon City; to carry on the business of generating and transmitting electricity for the purposes of lighting, heat and power and transmission of power; also to construct a railway from the west end of the suspension bridge in Oregon City to a point at the mouth of the Tualatin River, and to run railways in general in Oregon City. The Willamette Falls Company will have charge of the land and development department of the Portland General Electric Company, and will operate the electric railway built on that company's land, as above described. The officers of the auxiliary company are: P. F. Morey, president; H. W. Goode, vice-president; C. H. Caufield, secretary; Chas P. Thore, manager, and H. Z. Burkhart, assistant manager.

CANADIAN NOTES.

OTTAWA, July 22, 1893.

Hull, Que.—The question of forming an electric railway company in Hull, with the object of running an independent system in this city, has been talked up rather freely of late by the aldermen and leading citizens.

The Montreal Street Railway Company has begun the work of relaying the track on Notre Dame street, between McGill street and St. Lambert Hill, as well as upon Craig street east. Altogether some 1,500 men are employed.

A Company was recently formed at Lethbridge, N. W. T., for the purpose of putting in a telephone system from Lethbridge to Lee's Creek, a distance of 48 miles. The Dominion government gave a subsidy of $2,100, and the Mormons have also contributed.

The Ottawa Car Company, with a capital of $200,000, is applying for a charter, the object for which incorporation is sought being the construction of electric street railway cars. Wylie, Thomas Ahearn, W. Y. Soper, John W. McRae and William Scott are to be the first directors of the company.

The Ministerial Association, of Toronto, recently held a special meeting to decide on a course of action in regard to the agitation for running street cars on Sunday. An impression has been given that the clergy of the city are not unanimously opposed to Sunday cars. The members of the association take exception to this contention and will take steps to ascertain the views on the subject of every Protestant minister in the city. A resolution to that effect was passed.

A circular has been issued to the stockholders of the Ottawa Electric Railway Company and the Ottawa City Passenger Railway Company, informing them that $12,000 of the stock of the new Ottawa car company, which is being formed with a capital of $50,000, to acquire and extend the Wylie Car Works, has been reserved for them and may be subscribed for in $100 shares up to the 8th instant, when the stock books will be closed. Only $25,000 of the stock will be issued at present.

The Dominion Government is now testing the plan of operating canal lock gates by means of steel beams driven by electrical power, proposed by Mr. Munro, C. E., for adoption in the structure of the Soulanges Canal. The experiments are to be made at Meloshville, as there is water power at that place to drive the dynamos required in carrying on the tests. Should the scheme prove successful it will be applied to the gates of the enlarged canals now in course of construction.

Ottawa, Ont.—Application will be made to the High Court of Justice for an injunction restraining the City Council from signing the contract with the electric railway company. The grounds for the application as set forth in the documents are, among others, that the City Council have no power to grant a 30 years' franchise; that this Council cannot bind next year's Council to assist in getting legislation for the electric railway companies; also, that it is illegal to spend money without it being especially appropriated, and this the agreement calls for.

Vice-President Ward of the Commercial Cable Company, has been visiting Nova Scotia, in the company's interests. Speaking while there, with reference to the Commercial Cable, he said: "The two transatlantic cables which the company owns are fully taxed to carry the business offered. Within a year the company may lay a third cable. There is no more immediate prospect than there was a year ago of our constructing a transpacific line, though the day will doubtless come when the cable circuit will reach the Celestial Empire, and the far East generally." Mr. Ward will visit the Commercial cable station at Canso before his return to New York. The staff operators there, under the superintendency of Mr. Dickenson, number 52.

Montreal.—Ald. Clendenning presided at a meeting of the Electric Railway Committee recently, when the sub-committee submitted resolutions in favor of permission being granted to the Montreal Belt Line to construct their road through the city of Montreal, under the conditions of their charter, from east to west, double or single track, entrance to be from the eastern city limits along St. Catherine, Delormier, Craig and St. James streets to the western city limits, the company to pay $2,000 a mile in the city proper, to be responsible for all damages, and all its appliances to be approved by the City Council, and if the road is not built by June 1, 1894, the Park and Island Railway Company shall enjoy all the privileges granted to the Belt Line Company, and to complete their line by June 1, 1895. Also that Robert Bickerdike be given permission to build and operate a line from Dominion street along St. James as far as Little Craig street, and along Craig street to the Champ de Mars, and to pay $1,200 a mile for the first year, $2,000 a mile afterwards, the line to be built three miles west from the city limits and pass through Ste. Cunegonde, St. Henri and Cote St. Paul.

Toronto.—When the city of Toronto took over the old Street Railway Company's plant at a valuation, Senator Frank Smith and his partners put in a claim for the proper franchise they considered they held. The arbitrators decided that they only had a thirty-years' concession and refused to allow them a cent for the franchise, which, at their calculation, was worth from $500,000 to $700,000. The old company brought the case through every court in Canada and were beaten. They carried it to the Privy Council in England, and there the case came up before the law lords this week. Hon. S. H. Blake cabled from London on Wednesday: "Appeal virtually dismissed." This means that the Privy Council made short work of the claim and that the city owns its streets and car rights over them. The dismissal of the appeal also means that the city is declared owner of a number of pavements laid on the track, allowances subsequent to the agreement of 1889, under which the city did the paving and the company paid $600 yearly per mile for the maintenance of the streets. This decision is of the highest importance, as setting at rest the present company's contention, that although the city now pays the track allowances, the company, because of a payment of $500 per mile yearly, owns the pavements at the end of the lease.

Storage Battery Traction.—Alex. Woods, agent for the Julien system of electric storage battery for Canada, has received the following communication from Mr. Julien, the inventor and patentee of the system: BRUSSELS, June 17, 1893.—"The Montreal *Daily Star*, of the 30th of May last, published some information given by Mr. Rainville, on the storage battery service in Paris, and it is said, among other things, that the cars have only the ordinary speed of horse vehicles, and it is further presumed that the service is not a paying one for those who have organized it. This is not truthful. The traction by horses in Paris, in the tramways in question, costs 52 centimes for each vehicle per kilometre, while the traction by electricity only amounts to 45 centimes, and you must further take into consideration this fact: that the horse vehicles have only 48 seats, while the electric cars seat 56, which makes on the one hand a decrease of seven centimes on the traction and an increase in the receipts which may be put down, on an average, at one franc 60 centimes per trip. As the car covers 115 kilometres and 8 trips daily the benefit is therefore 20 francs per day for each car. In so far as the speed is concerned Mr. Rainville must have noticed that the electric cars run between horse vehicles, and that consequently the speed of the former cannot surpass that of the latter. This of course will be different when the horse vehicles are entirely done away with." It is the Julien system which is being operated by a French company in Paris.

News of the Week.

ELECTRIC LIGHT AND POWER.

Newton, N. J., has voted for the electric light.

Flemington, N. J., is to have the electric light.

Yoakum, Tex., is talking of an electric light plant.

Greenfield, O., has appropriated $20,000 for an electric light plant.

Boswell, Ind —The Town Council is contemplating putting in an electric lighting plant.

The Chillicothe (Ill.), Waterworks Company propose to put in an incandescent plant.

The Essex County Electric Company, of Orange, N. J., will replace its present incandesent lights by the Westinghouse system.

Burlington, Ia.—The electric light plant has been sold to Mr. George H. Spahr, who will take possession at once and conduct the business.

Smyrna, Del., will vote on July 24 in the matter of issuing bonds to the amount of $25,000 for an electric lighting plant and a sewer system.

Wheeling, W. Va.—A company, of which George W. Woods is president, has been formed to light the pike with arcs from the Park to Fulton.

Rochelle, Ill.—The Rochelle City Council has passed an ordinance appropriating $10,000 for constructing, erecting and operating an electric lighting plant.

Toledo, O.—It is now proposed to establish an electric lighting plant in connection with the water-works plant. The plan is to cable the wires and run them underground.

Springfield, Brown County, Minn., has decided by a large majority to issue bonds to pay for cost of purchase and maintenance of an electric lighting plant.

Harrisburg, Pa., has been offered a street lighting plant free after five years if it will pay the proposed company the same rate during that time it is now paying for its light.

Belair, Md.—The contract for the electric lighting plant has been awarded to Rigby & Hughes, of Baltimore, to be 60 lights of 50 c. p. each, and to be in operation in 90 days.

Caledonia, Minn.—The village of Caledonia has purchased some lots adjoining the City Hall for the purpose of drilling an artesian well with a view to water-works and an electric lighting plant.

Salt Lake, Utah —R M. Jones has obtained the City and County franchise, and will organize a company with $500,000 capital to construct a tunnel and plant to transmit power from the Big Cottonwood.

Mexia, Tex.—The City Council has made arrangements to have an electric lighting plant put in at once. Alderman J. W. Blake and J. E Ross were appointed a committee to close a deal with some electric company.

Stoneham, Mass.—The matter of a bond issue for a municipal electric lighting plant was laid on the table, it being the general belief that the financial stringency would preclude any chance of raising money on fair terms.

Etna, Pa., will vote Aug. 22 in the matter of issuing bonds to the amount of $100,000, of which $15,000 will be devoted to the purchase of an electric lighting plant for the borough, to be operated in connection with the waterworks plant.

Tannersville, N. Y —The Hunter Electric Light and Power Company is to be located at Tannersville within four months, and Frank Haines, of the company, is now making contracts. He may be addressed at Hunter, in Greene county.

Lowell, Mass.—The Lowell *Citizen* calls attention to the fact that the contract for street lighting with the Lowell Electric Light Company expires Aug. 1, and that steps should be taken in the matter of securing a municipal electric light plant.

Jonesville, Mich.—A franchise has been granted to Avis & Pomeroy for 20 years to erect poles and string wires in the village for electric lighting. Also a contract for lighting the streets. The plant will be in operation Oct. 1. The power to be used will be water.

St. Louis, Mo.—Sealed proposals will be received at the office of the Building Department, Aug. 4, for combination gas and electric lighting fixtures for the new High School on Grand avenue, near Bell street, as per specifications on file. F. W. Brockman is chairman of the Building Committee.

Newton, N. J.—At a meeting held to receive the report of the committee on the proposed electric lighting plant for the town, the general sense of the meeting was that the town should own a plant, estimated cost $30,000. John Karr and another resident of Newton stand ready to build and operate a plant.

Windsor Locks, Conn.—The directors of the Windsor Locks Electric Lighting Company, at a meeting held in the office of E. B. Bailey here, decided to borrow money with which to increase the capacity of their plant. A new 150-h. p. boiler and 100-h. p. engine will be put in, the dynamos increased from their present capacity of 1,500 lamps to 3,000 lamps, and other improvements will also be made.

Rahway, N. J.—Sealed proposals will be received by the Committee on Lamps and Police of Rahway, N. J., to July 25, for lighting the streets by gas, electricity, petroleum, or any other method, also for lighting the centre part of the city with gas or electricity, and the outskirts with petroleum or other light, from Aug. 1, 1893, to July 1, 1894. To be 50 incandescent lights or 50 arc lights of 2,000 c. p., all as per details to be had of C. B. Holmes, Fred. Eyer or A. Lohmiller, committeemen.

Asbury Park, N. J.—The Neptune Electric Company has its enlarged plant in complete running order. The additions comprise a new brick building 60 by 85 feet, a 600-h.p. Philadelphia Corliss engine; a 3 000-light Fort Wayne alternator--Woods' latest machine; a Falls Rivet countershaft, 94 feet long; a 50-light Thomson-Houston arc machine and a 250-h. p. National water tube boiler. The present capacity of the plant is 250 arc and 6,000 incandescent lights. Seventy-five miles of "O. K." wire have been used in extending the lines to adjacent territory, and the company is now lighting 14 towns, including Spring Lake, Belmar and Avon. Another 600-h. p. Corliss engine will be put in next spring

THE ELECTRIC RAILWAY.

Galion, O., is talking of an electric road.

Youngstown, O., and Lauteman's Falls are to be connected by an electric railway.

Salamanca, N. Y., and Little Falls are talking of a connection by electric railway.

The Philadelphia Electric Traction Company has increased its stock to $2,500,000.

Malden, Mass.—The West End Railway has been granted permission to equip and operate by electricity.

Tecumseh, Mich.—S. D. Nesmith has been granted a franchise to run an electric road through Tecumseh.

Elmira, N. Y.—The West Side Railway will put in a new 3 h. p. engine and two new generators of 125 h. p. each.

Eckley and Buck Mountain, Pa., will be connected by an electric railway, Coxe, Bro. & Co. having let the contract to Chas. F. King & Co.

Philadelphia, Pa.—The Philadelphia Traction Company will build a large addition to its power house at Sutherland avenue and Riggs street.

Utica, N. Y.—Another movement is being heard from here to build the Utica, Rome & Sylvan Beach Railroad, and a preliminary survey has been made.

Beaver Falls, Pa.—Simon Harrold has the contract for nine miles of electric railway between McKee's Rocks and Coraopolios. The total cost will be about $140,000.

The Canadian Pacific Railway Company, according to Premier Davies, contemplates the employment of electricity in drawing trains up Kicking Horse Canyon on the line to the coast

Springfield, Ohio.—E. D. Hotzenpiller has begun work on an electric line between Magnetic Springs and Columbus. A spur to Delaware is contemplated. He will also furnish light and power to farmers en route.

New Orleans, La.—The St. Charles Street Railway Company stockholders are in favor of increasing the capital stock of the company and changing the motive power to electricity. The cost of the improvements is estimated at from $270,000 to $400,000.

Bridgeport, Conn.—The Bridgeport Railway Company, the Bridgeport Horse Railroad Company and the East End Railroad Company have consolidated under the name of the Bridgeport Traction Company, capital $2,000,000, and the roads are soon to be operated by electricity.

Melrose, Mass.—General Manager Foster, of the Lynn & Boston road, generally known as the East Middlesex Street Railway Company, has been consulting with the selectmen of Melrose, and it is stated that the result will be the running of the cars through Melrose by electricity.

Johnstown, N. Y.—At a meeting of the directors of the Johnstown & Gloversville Horse Railroad Company, held at the office of Harwood Dudley in Johnstown, a resolution was passed to put the track on Main and William streets in a condition to be operated by electricity at once.

Stoneham, Mass.—The board of directors of the Mystic Valley Street Railway Company, including Arthur L. Wyman, George S. Littlefield and David H. Skillings, have petitioned the Selectmen of Stoneham for right of way for an electric street railway from Stoneham to Winchester, and eventually to Arlington.

Beaver Meadow, Pa.—The work of building the Beaver Meadow, Hazelton & Mahanoy City Electric Railway Company, one of the longest electric railways in the State, will again be prosecuted. The road will run from Beaver Meadow to Mahanoy City and thence probably to Pottsville, a distance of 40 miles.

Dedham, Mass.—The permanent organization of the Norfolk & Suburban Street Railway Company has been effected. John R. Bullard, of Dedham, is president, and Thos. T. Robertson, of Dedham, Mass., is secretary treasurer. Erastus Worthington, Jr., will be the engineer. Work will at once be commenced, and the owners hope that the road will be in running order Oct. 1.

Mount Vernon, N. Y.—Referring to the application of the Westchester Electric Railway Company for permission to use horses instead of electricity, a meeting will be held of the taxpayers on July 18, when it is expected that a resolution will be passed forbidding the company to use horse power. Unless the company shows a disposition to hurry its work, the citizens will surely demand a forfeiture of the franchise.

Trenton, N. J.—Wm. J. Thompson, of the Gloucester race track; Thos. Curley and J. Willard Morgan have been granted permission by the Electrical Subway Commission to put up poles and wires for a trolley road from Kaighn's Point Ferry to the terminus of the road and then to connect with the Camden, Gloucester & Woodbury electric road. This company is now before the Woodbury Council with a petition to operate a road by electricity through these streets, but the matter has not been favorably received by Council.

The Scranton & Carbondale (Pa.) Traction Company has acquired the right of way of the Blakely & Dickson Traction Street Railway Company, on the turnpike that extends from Scranton north to Archbald, and connects all the towns and villages north of Scranton in the Lackawanna Valley. The contract for the entire roadbed and track construction was given to the Johnson Company, of Johnstown, Pa., and for the overhead work to J. G. White & Co., of New York City. There will be 16 Brill cars equipped with General Electric Company's motors. The Berlin Iron Bridge Company has the contract for the fireproof buildings, and the entire construction is under the supervision of Mr. A. H. Chadbourne, of Philadelphia.

LEGAL NOTES.

Preliminary Injunction.—A motion for a preliminary injunction to enjoin a passenger railway company from using electricity for motive power was properly refused where the question involved is whether a passenger railway company, incorporated with authority to use only horse power for traction of its cars, can be converted into an electric railway company by the action of the municipal authorities of the city in which the company's road is, such question never having been passed on by the Supreme Court and being of too serious a character to be passed on without a hearing of the case on all its facts.—(Fritz v. Erie City Passenger Railway, Supreme Court of Pennsylvania, 26 At., Rep. 653.)

Vested Rights of Electric Light Companies.—Where an electric light company has under an authorized contract with the city, allowing it to erect poles and string wires in the streets, expended money in establishing its plant and appliances, it has a vested right to use its wires, which cannot be infringed by another company stringing wires interfering with theirs under a subsequent contract with the city. Where the second company in such case strings its wires so close to those of the first company as to interfere with them and in such a position as to cause danger to the first company's employés, it will be required to pay the damages caused thereby and will be perpetually enjoined from such interference.—(Rutland Electric Light Company v. Marble City Electric Light Company, Supreme Court of Vermont, 26 At. Rep., 635.)

PERSONAL NOTES.

Mr. E. S. Boggs, manager of the New York Electrical and Development Company, was married Wednesday, June 28, to Miss Lillian Vail, of Brooklyn, N. Y. The ceremony took place at Saratoga, where the happy couple spent their honeymoon.

Dr. John Sahulka, the official delegate to the congress from Austria, will read papers on the following subjects: "Various Uses of Electrostatic Voltmeters," "Explanation of the Ferranti Phenomenon," "Action of Elihu Thomson's Transformer-Motor."

MISCELLANEOUS NOTES.

Prof. Forbes has stated that 20,000 volts will be used to transmit power from Niagara.

The Engineering Association of the South, Nashville, Tenn., at its last meeting had a paper presented by Prof. Olin H. Landreth, of Vanderbilt University, on smoke prevention.

The Westinghouse Electric and Manufacturing Company, it is reported, will concentrate all of its new manufacturing business in its new works, and proposes to close the Newark works at once.

The Civil Engineers' Club of Cleveland, O., has issued a neatly bound 81-page book entitled "Visitor's Directory to the Engineering Works of Cleveland, Ohio." A number of blank pages at the end are for visitors' notes. The various engineering features of this great manufacturing centre are described, and the data given, which are useful to the professional man. This innovation is a commendable one, and implies a civic and professional pride that creates an agreeable impression and speaks well for the membership of the Cleveland Civil Engineers' Club.

The University of Wisconsin has issued its 1892-93 catalogue, from which we learn that during the last year there were 1,287 students, of whom 72 were in the electrical engineering course. Prof. Dugald C. Jackson and John E. Davies are in charge of the electrical instruction. We note that the course in electrical engineering is differentiated, the instruction not being the same for those who expect to enter the field of practical electrical engineering and construction and those who expect to be teachers or to deal with the purely scientific side of the profession.

An Induction Street Railway System.—The Ries Electric Company, of Baltimore, exhibits a model of an electric railway operated by an ingenious application of the principles of induction, on the same principle used in train telegraphy. Practically the wires carrying the current are laid beneath the street surface, between the rails and covered over. The car has a coil under it close to the surface of the street, which takes the current by induction from the coils laid beneath the street surface; the current so induced is conveyed to the motor running the car.

Electrical Jurors.—In addition to the list of electrical jurors given in these columns last week are the following: Dr. Chas. E. Emery, New York City; A. E. Dolbear, Tuft's College, Mass.; W. E. Ayrton, F. R. S., London; George Forbes, M. A., F R. S., London; Director Rathenau, Berlin; Daurath Ulbricht, Berlin; Pierre Dehausse, Belgium; Wm. Shrader, University of Missouri; S. Brown Ayres, Tulane University, Louisiana; D. C. Jackson, University of Wisconsin, Madison; S. Thompkins, Clemson College, S. C.; R. W. Pope, Sec. Am. Inst., E. E. It has been decided that the president of the jury shall be an American and that two vice presidents will be chosen, one of whom shall be English and the other German. This discrimination against other foreign countries will probably be the cause of dissatisfaction and friction.

Trade and Industrial Notes.

Messrs. Wm. C. Callman & Co., 136 Liberty street, New York, report large sales of the Phœnix lamp, for which they are agents.

The Railway Equipment Company, Chicago, Ill., has issued two folders describing a number of its Type G overhead fittings.

Albert & J. M. Anderson, Boston, Mass., have issued a 38-page illustrated catalogue of electric railway, light and power specialties manufactured and handled by them.

The Dwight Slate Machine Co., 212 Main street, Hartford, Conn., has developed an improved feed for the Gatling gun, and is now engaged in adapting an electric motor to operate it with the assistance of the Eddy Electric Company.

C. S. Knowles. 5 and 7 Arch street, Boston, has issued catalogue No. 2 of material and specialties for electrical purposes. Among other specialties we remark the well known "Tenax" splicing compound and tape and the efficient porcelain cleat recently described in our columns.

Queen & Co., Incorporated, Philadelphia, Pa., have recently issued a circular letter regarding their extensive electrical exhibit at the World's Fair, and calling attention to the more important pieces of apparatus in their display, which were fully described in THE ELECTRICAL WORLD of July 15.

The Ball & Wood Company, 15 Cortlandt street, New York, has built and installed a number of engines such as we describe on another page, connected to the leading makes of dynamos, and has just completed three engines of this character for the new Metropolitan Club of New York.

The Ansonia Electric Company, Randolph street, Chicago, has recently shipped a number of W. W. lightning arresters to the oldest and largest electric manufacturing company in Germany, and they are receiving orders for the same and for Wirt dynamo brushes from England, New Zealand, India and other foreign countries.

The Alimanna Svenska Elektriska Aktiebologet, Vesterrs, of Stockholm, Sweden, sends us a copy of its handsome 1893 catalogue, 136 pages. This firm manufactures the well known Wenstrom dynamo and deals in general electrical supplies; among those illustrated are the Lundell fan motor and the Thomson wattmeter.

Sylvester P. Denison, 113 Centre street, New York City, designer and builder of fine machinery, and who makes a specialty of model and experimental work, reports business exceedingly good, having recently received some very large orders in the above line. Mr. Denison is a practical machinist and employs nothing but strictly first-class workmen.

The H. W. Johns Manufacturing Company, 87 Maiden lane, New York, supplied the asbestos fire-felt covering for the boilers, steam pipes, etc., of the United States gunboat Machias, which on her recent speed trial accomplished the unprecedented feat of exceeding her guaranteed speed by nearly 2½ knots, thus winning a premium of $45,000 for her builders.

The Goulds Manufacturing Company, Seneca Falls, N. Y., has issued a supplement to its pamphlet on "Efficient Power Pumps," comprising recent improvements and additions to its manufacture of triplex power pumps. Among other additions are a hydraulic pressure pump, an ammonia power pump and useful directions for placing and operating the celebrated line of pumps made by this firm.

The Electric Appliance Company, 242 Madison street, Chicago, report that they have already sold several hundred Meston fan motors, and are filling large orders every day for country as well as city trade. A very large number are now in use at the Fair, and the Electric Appliance Company expect to

have several hundred motors installed there before the season is over.

The Interior Conduit and Insulation Company, 44 Broad street, New York, the manufacturers of the Lundell fan motor, state that two fan motors, one at either end of a room, give the best results. One thus will draw in the cool air and another drive out the hot, thus keeping up a constant circulation; it is further recommended that hot air should not be driven into ventilating shafts, but discharged through the street ventilators in sidewalks.

The Mica Insulator Company, 218 Water street, New York, is placing on the market a new insulating material called Micanite Paper. This material is unequaled for new work or repairing. It is made in sheets 32 by 32 inches. This company is meeting with success in introducing Micanite, and it has received some very strong testimonials from the leading electrical manufacturing companies and railroads throughout the United States. It has also established agencies in Europe.

The Hogan Boiler Company, Middletown, N. Y., has issued the first number of the "Quarterly Boiler Review." While the avowed object of the publication is to advance the interests of the Hogan boiler, it contains much information of use to the users of boilers in general, and the very clever style of the principal writer renders it entertaining to an unexpected degree. The matter contained in the book has an engineering value beyond that generally found in trade publications.

Teeple Electric Construction Company, composed of the following gentlemen: N. S. Teeple, president; N. L. Teeple, secretary, and W. S. Teeple, manager, has been organized, with offices at 136 Liberty street. All of the above gentlemen are experienced and practical men, and hence feel competent to enter the field as a competitor. N. L. Teeple was formerly employed by the Tucker Electrical Construction Company, of this city, and latterly by the General Electric Company. W. S. Teeple has been connected with the Sawyer-Man, Westinghouse and Edison companies. This company will make a specialty of remodelling construction work.

The Pratt & Whitney Company, Hartford, Conn., has issued a 390 page duodecimo, 1893 edition of their descriptive catalogue which illustrates and describes a portion of the machines and tools manufactured by this great firm, the aim of the catalogue being to give representations of classes rather than a list of individual items. The manufactures of this company are so well known that it is unnecessary to refer to them, but to give an idea of the immense extent of their facilities we extract the following: "In the machine shops are 400 lathes of various kinds, 115 planers, 85 drilling machines, 120 milling machines, 18 screw machines, 13 gear and rack cutters, 10 boring mills, and 200 other machines in addition to the tools used in the pattern shop." Two supplementary pamphlets, one of 76 pages, are issued as price lists.

Business Notices.

Battery Cut-Out, Cheap.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 125 South Warren street, Syracuse N. Y.

Notice.—The electric light plant heretofore owned and operated by A. W. Wright, at Alma, Mich., has been purchased by the undersigned, to whom all communications should be addressed.

ALMA SANITARIUM CO.
(Electrical Department).
ALMA, MICH.

The Western New York & Pennsylvania Railroad Company is the short and popular route from Buffalo to Olean, Bradford, Dunkirk, Mayville, Titusville, Oil City, Pittsburgh, Philadelphia, Baltimore, Washington and the South. It is the only line running solid trains with Pullman buffet and sleeping cars daily between Buffalo, Oil City and Pittsburgh. The general office is at 84 Exchange street, Buffalo, N. Y. Trains leave New York Central & Hudson River Railroad Depot.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

UNITED STATES PATENTS ISSUED JULY 4, 1893.

[In Charge of W. A. Rosenbaum, 177 Times Bldg., N. Y.]

500,545. Telephone System; G. L. Anders, London, England. Application filed Dec. 1, 1892. A microphone formed of or containing a loose mass of separated carbonized fibres, such as carbonized cotton fibres.

500,563. Signaling System; W. E. Decrow, Boston, Mass. Application filed Dec. 31, 1892. A transmitter circuit, magnet closer in a local circuit, a second circuit closer in the local circuit, a locking device for the first circuit closer and an automatic releasing mechanism acting to release the first circuit closer.

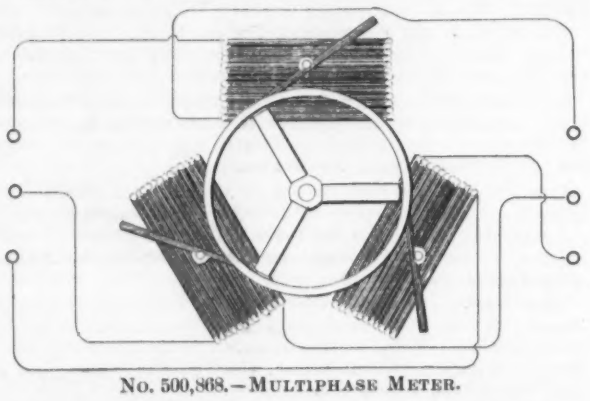
500,579. Power Transmission; A. L. Ide, Springfield, Ill. Application filed July 19, 1892. The combination with an engine, and driving its pulley, of a frame pivotally mounted upon the engine base, and an idler pulley carried by the frame.

500,601. Safety Cut-Out; Olof Offrell, Middletown, Conn. Application filed Dec. 5, 1892. A fusebox with a longitudinal septum dividing it into compartments, a recess at each end of each compartment, a hole in each compartment adjacent to one of the recesses and extending through the back of the box and a septum interposed between the hole and the adjacent recess.

500,604. Method and Apparatus for Separating Ores; C. Q. Payne, Stamford, Conn. Application filed April 19, 1892. The combination of an iron screen and an electromagnet provided with polepieces, a lamellar distribution of magnetism being produced in those portions of the screen opposite the faces of the polepieces.

500,605. Magnetic Ore Separator; C. Q. Payne, Stamford, Conn. Application filed May 23, 1892. An operating screen and electromagnet provided with polepiece, the attracting force being equalized across the widths of the two portions of the screen opposite the faces of the polepieces.

500,606. Device for and Method of Adjusting and Equalizing the Magnetic Density in the Polepieces of Magnetic Separators; C. Q. Payne, Stamford, Conn. Application filed May 26, 1892. An electromagnet provided with polepieces, the component parts of which electromagnet are so subdivided and energized that a uniform distribution of magnetic density is secured across the widths of the polar faces.



No. 500,868.—Multiphase Meter.

500,614. Brush Holder for Dynamo-Electric Machines; H. G. Reist, Lynn, Mass. Application filed Jan. 28, 1893. This comprises a socketed front rail, a rear rail, multiple-connecting crossbars and spring actuated brush arms hinged to the rear rail between each pair of crossbars.

500,622. Secondary Battery; W. L. Silver, Lima, O. Application filed July 9, 1892. In a secondary battery a connecting device, consisting of a cast metal screw of lead, the rod passing through battery plates and having an integral head on one end, the other end of the rod having a connecting strip of metal to which it is clamped by metal nuts.

500,629. Electric Switch; Elihu Thomson, Lynn, Mass. Application filed April 20, 1890. This consists of a series of insulated conducting pieces with their successive discharge points arranged out of line with one another so as to form a zigzag series of breaks tending to prevent the continuance of an arc. (See illustration.)

500,630. Method of and Means for Producing Alternating Currents; Elihu Thomson, Swampscott, Mass. Application filed July 18, 1892. This consists in establishing a circuit of high self induction, rupturing the circuit at a spark gap, and diverting the current through a shunt containing a condenser and a self-inducing coil. (See illustration.)

500,631. Rheostat; Elihu Thomson, Swampscott, Mass. Application filed Aug. 25, 1892. An electric resistance composed of a flat spiral of metal having insulation between the turns, the whole being held between sides of rigid refractory material.

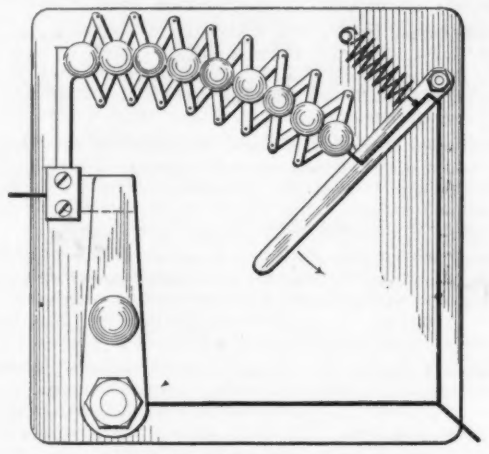
500,657. Electric Arc Lamp; R. M. Hunter, Philadelphia, Pa. Application filed April 3, 1893. The combination of two fixed carbon holders, two vertically adjustable carbon holders, a mechanical device connecting the two adjustable carbon holders whereby one may adjust the other automatically, and an electrically controlled regulating device for simultaneously feeding the adjustable carbon holders toward the fixed carbon holders.

500,663. Electric Motor; John MacHaffie, Schenectady, N. Y. Application filed Oct. 8, 1891. A shaft and a movable thrust block surrounding it, with regulating devices connected to the thrust block for regulating the source of power.

500,668. Railway Signal Apparatus; J. C. Georges Mugnier, Paris, France. Application filed Oct. 19, 1892. This comprises a slide or weight and electric contacts to which the weight serves as a closer at the proper moment, together with the treadle mechanism acted on by the train and the intermediate parts for transmitting movement to the signal apparatus.

500,670. Incandescent Electric Lamp; W. E. Nickerson, Cambridge, and E. E. Clary, Boston, Mass. Application filed April 1, 1893. The combination of a glass globe having a conical unground neck, a filament and leading-in wires and fusible cement.

500,671. Incandescent Electric Lamp; W. E. Nickerson, Cambridge, Mass. Application filed April 3, 1893. The combination of a glass globe, the neck of which is rendered tight by means of a fusible cement, a filament and leading-in wires; a heat reflecting disc located in the vacuous portion of the lamp between the filament and that part of the neck of the lamp occupied by the fusible cement, the disc being adapted to reflect the heat of the filament and prevent the softening of the cement.



No. 500,629.—Electric Switch.

500,681. Electric Soldering-Iron and Heater; August Tinnerholm, Schenectady N. Y. Application filed July 11, 1892. This consists of a hollow spool of wire, having therein a shank or tip to be heated, the spool being encased in a metal cover, the cover and spool being covered on the outside with enamel.

500,726. Lightning Arrester; C. S. Van Nuis, New Brunswick, N. J. Application filed Aug. 20, 1892. The combination of fusible wires, binding pellets for holding the wires in proper relative position, an inclosing tube and fillings for closing the tube.

500,767. Electro-Medical Appliance; Sophia Hetherington Carruthers, Sydney, N. S. W. Application filed Oct. 6, 1892. A textile fabric or towel having metallic conducting strips or bands and the battery electrically connected with the strips, the battery being also mechanically connected with the towel and portable therewith.

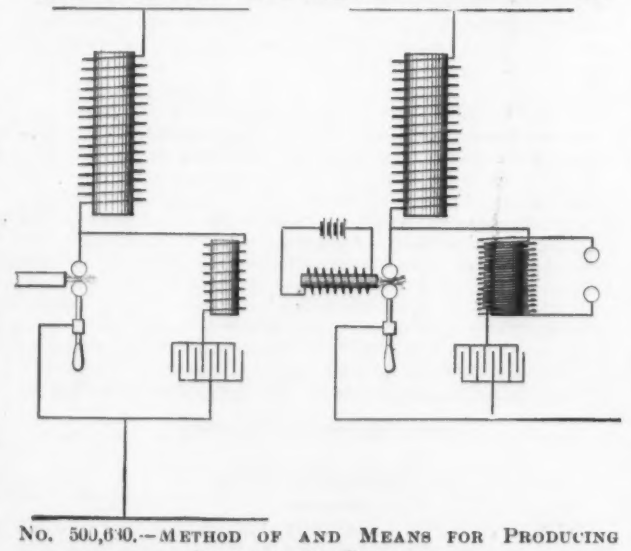
500,775. Apparatus for Recording the Flexure of Bridges; Emile Parenthou, Paris, France. Application filed July 8, 1892. A stylus with operating means therefor, a cylinder, electromagnet, armature, ratchet and ratchet shaft operated by the armature, the cylinder shaft having a worm wheel and the worm on the ratchet shaft.

500,776. Coin-Operated Induction Coil; W. R. Pope, Baltimore, Md. Application filed April 3, 1888. This consists of a case containing a battery, electromagnet, chute, circuit breaker, handles outside the case, wires extending from the handles to contacts on the door of the case, and wires extending from the secondary circuit of the induction coil to contacts on the case arranged to meet those on the door when the latter is closed.

500,822. Electric Hose Coupling; J. B. Strauss, Cincinnati, O. Application filed Jan 31, 1893. A wire applied to the hose and communicating with a coupling of the same, a chain attached to the coupling for the purpose of preventing any elongation of the hose and breaking of the wire.

500,827. Railway Signal System; G. L. Thomas, Brooklyn, N. Y., and E. C. Seward, Montclair, N. J. Application filed March 6, 1893. A pair of discs spaced apart and mounted to rotate independently of each other, each disc being provided with a set of signals, a housing covering the signals so as to leave only one signal on each disc exposed at once, disc actuating mechanism, and signal operating mechanism under the control of the passing train.

500,828. Lightning Arrester; W. A. Turbayne, Detroit, Mich. Application filed Nov. 5, 1892. The combination with two stationary separated carbon points, having connection respectively with the line and the ground, a magnet in the ground circuit, a lever carrying at its lower edge a bridge with complementary carbon points, an adjustable screw for adjusting the break between the stationary end and movable carbons, and an armature at the upper end of the lever, arranged in proximity to the magnet.



No. 500,640.—Method of and Means for Producing Alternating Currents.

500,829. Electric Arc Lamp; W. A. Turbayne, Detroit, Mich. Application filed Nov. 5, 1892. A frame, suspended carbon holder and means for moving the holder laterally, consisting of a wheel rotated by engaging one of the standards, and a connecting rod from a crank pin on the wheel to the carbon holder.

500,849. Electric Incandescent Lamp; H. D. Burnett, Lynn, and S. E. Doane, Swampscott, Mass. Application filed Oct. 28, 1892. An incandescent electric lamp, a filament and conductor supporting its ends, consisting of wires of a grooved or indented section, whereby the ends of the filament may be seated in grooves or notches therein and be held in place by its own elasticity. (See illustration.)

500,851. Electric Locomotive; L. W. Case, Highland Park Conn. Application filed May 9, 1891. A supporting track provided with a conducting strip, a car, an electric motor supported on the car and having the ends of the armature shaft provided with commutator strips arranged to form driving wheels for the car with the terminals of the coils connected up to commutator strips on diametrically opposite sides of the commutators.

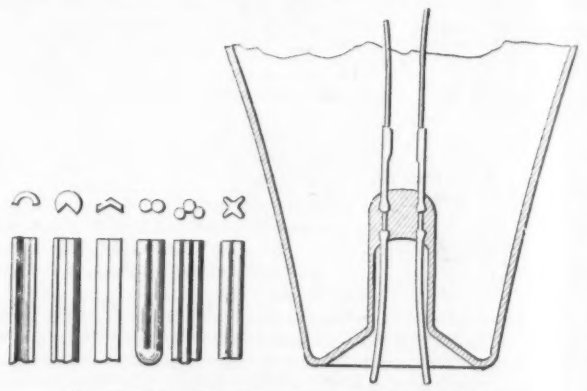
500,868. Multiphase Meter; Thos. Duncan, Fort Wayne, Ind. Application filed Sept. 3 1892. In an electric meter or motive device, a plurality of coils in combination with a rotating closed circuit or secondary, arranged in inductive relation to the coils, and a magnetic diverter determining the angle of the lines of force. (See illustration.)

500,902. Ring Armature; C. W. Jefferson, Schenectady, N. Y. Application filed Feb. 13, 1893. The combination of an iron ring core, and a covering for the same, consisting of sheets of mica cemented together with overlapping edges.

500,918. Electric Switch; G. E. Linton, Worcester, Mass. Application filed April 11, 1893. A base, binding posts arranged in sets of two on the base, a lever having an end shaped like the frustum of a wedge pivoted between the arms of a stand, the stand being in line with and midway between two sets of binding posts, and adjustable flat blade spring having one end secured under the stand and the other end in contact with the pivoted end of the lever.

500,937. Conduit Railway Insulator; G. E. Noyes, Washington Grove, Md. Application filed Aug. 8, 1892. Insulators having the under side concave, and countersunk screws at each end for securing the line wire in its position.

500,943. Electric Railway System; F. S. Perrin, Lynn, Mass. Application filed April 2, 1892. An underground conduit, having a narrow longitudinal slot of two shutters pivoted below the slot, one on each side of it, each of these shutters having an arm projecting below the pivotal point.



No. 500,849.—Electric Incandescent Lamp.

500,957. Earpiece; R. Seiffert, Chicago, Ill. Application filed Feb 23, 1893. An earpiece of the kind specified consisting of a disc having a centrally located projection on one side, and a perforation extending through the disc and projections.

500,973. Electric Welding Machine; M. M. Suppes, Johnstown, Pa. Application filed Sept. 10, 1892. Supports movable transversely to plungers, contact and swaging blocks mounted thereon, the supports normally holding the blocks away from each other.

500,978. Secondary Electric Battery; C. Theryc and A. Oblasser, Paris, France. Application filed Dec. 2, 1892. The process of making a secondary battery element, by forming an envelope with perforated sides, from sheets of celluloid or similar material in a plastic or pliable condition, filling the envelope with active material and a conductor, closing the openings through which the receptacle was filled, and subjecting the entire element to heavy pressure.

501,000. Meter for Alternating, Pulsating or Intermittent Electric Currents; Thos. Duncan, Fort Wayne, Ind. Application filed Oct. 10, 1892. The combination of a revolving secondary or armature, a primary coil or electromagnet traversed by the current to be measured, and a diverter whose magnetic and diverting properties are imparted or communicated thereto by means of a shunt or multiple arc fine wire winding, wound upon a non-metallic core and representing the fall of potential in volts of the generator or source of supply.

501,009. Overhead Electric Railway; J. C. Henry, Westfield, N. J. Application filed Sept. 27, 1889. The combination of the working conductor of an electric railway, having guy wire supporting posts staggered on opposite sides of the track.

501,021. Insulating Coupling; Louis McCarthy, Boston, Mass. Application filed March 7, 1892. This consists of a layer of insulating material interposed between flanged portions of the insulator, with securing bolts passing through the same, these bolts being insulated by layers of insulating material, a metallic strip or ring through which they pass, this strip or ring being located under the heads of these bolts and interposed between the heads and the insulating material which surrounds them, whereby the bolts may be headed down without danger of injuring the insulating material surrounding same.

501,038. Metal Working; J. H. Bassler, Myerstown, Pa. Application filed Dec. 23, 1892. A method of uniting metals, which consists in first heating the materials to be united by an electric current, and, while the current is still flowing, pouring aluminium or aluminium alloy into the joint.

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1865 can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.